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FIRST AID

A BUREAU OF MINES
INSTRUCTION MANUAL



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Supersedes 1940 Manual of First-Aid Instruction



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UNITED STATES DEPARTMENT OF THE INTERIOR

Douglas McKay, Secretary

BUREAU OF MINES

J. J. Forbes, Director

PREFACE

The act of Congress establishing the Bureau of Mines delegated to the Bureau, as one of its principal duties and functions, study of health and safety in the mineral industries, with a view to devising and putting into operation means of conserving the health and safety of those employed therein.

Investigations during the earlier years of the Bureau demonstrated the urgent need for prompt, correct emergency care of those injured, especially in mines, as near as possible to the locality where the injury was incurred. Owing to lack of such emergency treatment, some of the injured frequently suffered long periods of disability, and others died from severe hemorrhage, asphyxiation, and shock.

One of the first health and safety activities of the Bureau of Mines was, therefore, organization of a trained force to promote instruction in first aid in the mineral industries. Recognizing that such instruction must be given in simple English and primarily from a lay standpoint, the Bureau wisely delegated it to men who were not doctors primarily but who had been thoroughly trained under medical supervision.

In the early days the training work was handicapped by lack of suitable first-aid publications. To overcome this handicap and to provide handbooks best suited to the persons to be trained, seven different publications have been issued by the Bureau of Mines, including the present edition of the Manual of First-Aid Instruction.

The following publications of the Bureau of Mines have been used in first-aid instruction to date:

Miners' Circular 8. First-Aid Instructions for Miners, by Dr. M. W. Glasgow, W. A. Raudenbush, and C. O. Roberts. 1913, 67 pp., 51 figs. Many editions were issued, and it served as a text for training purposes until 1917.

Miners' Circular 23. Elementary First Aid for the Miner, by Dr. W. A. Lynott and D. Harrington. 1916, 24 pp., 19 figs. This was printed in English, Italian, Polish, and Slovak.

Handbook. Advanced First-Aid Instructions for Miners, by Dr. G. H. Halberstadt, Dr. A. F. Knoefel, Dr. W. A. Lynott, Dr. W. S. Rountree, and Dr. M. J. Shields. 1917, 142 pp., 65 figs. This was the first complete textbook for industrial first-aid instruction published in the United States.

Handbook. Manual of First-Aid Instruction for Miners, a revision of the previous handbook, by Dr. R. R. Sayers. 1921, 206 pp., 99 figs.

Handbook. Manual of First-Aid Instruction, a revision of the Manual of First-Aid Instruction for Miners, by Dr. R. R.

Sayers, Dr. L. A. Shoudy, and G. W. Grove. 1930, 221 pp., 107 figs.

Handbook. Manual of First-Aid Instruction, a revision of the Manual of First-Aid Instruction for Miners, by Dr. Arthur L. Murray, G. W. Grove, and others. 1940, 361 pp., 113 figs.

The present revision was prompted by the need for a smaller manual, yet one that would include all essentials and fundamentals of first aid as taught by the Bureau of Mines. Few changes have been made in descriptions of injuries and their dressings, as contained in the 1940 manual; any such changes were to simplify or clarify methods of treating injuries that raised questions in the past. The manual was shortened by deleting sections that were not essential to teaching first aid.

A number of excellent first-aid manuals are available, but most of them differ to some extent in the care of injuries or application of dressings. Although these differences are not vital, they often are confusing in first-aid contests, which the Bureau of Mines has found valuable in promoting and maintaining interest in first aid.

The practice required for contests adds much to perfecting the first-aid understanding and technique of the members of first-aid teams. For the instruction and successful conduct of first-aid contests a standard of first-aid methods must be established and maintained. This Manual of First-Aid Instruction has therefore been revised to standardize first-aid procedure in all industries served by the Bureau of Mines so that it will be equally applicable to general first-aid instruction and contest work.

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FIRST AID

A Bureau of Mines Instruction Manual¹

Chapter I. INTRODUCTION

FIRST-AID TRAINING for employees of the mineral industries has been an important activity of the Bureau of Mines since it was established in 1910. Through the personnel of its safety stations in 15 States and Alaska, the Bureau maintains continuous contact with employees of the mining, metallurgical, petroleum, and quarrying industries. By instruction and demonstrations, information is disseminated regarding safe and unsafe practices, with a view to reducing accidents as well as teaching the correct emergency aid of injured persons until medical care can be obtained. Since creation of the Bureau in 1910 approximately 2,000,000 persons have received Bureau of Mines first-aid training.

BUREAU OF MINES FIRST-AID TRAINING

The Bureau of Mines standard first-aid course requires a minimum of 15 hours of instruction and practical work, exclusive of a period devoted to examining class members when they complete the course. The usual practice is to divide the course into five 3-hour periods. Where the time devoted to each period must be shortened, the number of periods must be increased to cover the full 15 hours, so that all subject matter of the course may be completed. Each period comprises oral instruction and a review of the work of the previous period, followed by demonstrations and practice work by the entire class. To each person who completes the course for the first time and shows by oral and practical

¹ Work on manuscript completed October 1952.

examination that he is properly qualified, the Bureau of Mines instructor awards a pocket card certificate, and the Bureau sends him a large, engraved, first-aid certificate suitable for framing.

Each person who is retrained later in the standard first-aid course and passes a satisfactory examination receives a pocket card certificate showing that he has completed additional first-aid training but does not receive a second large certificate.

COOPERATIVE FIRST-AID TRAINING

In 1926 the Bureau of Mines initiated cooperative first-aid training, by which the entire personnel of mines or plants could be trained in first aid in a single campaign within a few weeks. Many mines and plants have taken advantage of the cooperative plan.

With the aid of operating officials, a group of keymen in a plant or a mine is given intensive training in first aid for 30 hours by a Bureau of Mines instructor. Those of the group who exhibit well-rounded knowledge of first aid and an aptitude for teaching it are selected as tentative provisional first-aid instructors. To qualify, each must train a class of at least six persons employed in the mineral industries in the standard Bureau of Mines course in first aid, under the supervision of a Bureau of Mines instructor. When a tentative provisional first-aid instructor's class has been examined by the Bureau of Mines instructor and found to be trained properly, a provisional first-aid instructor's pocket card certificate, good for 1 year, is issued to the class instructor.

During each 12 months following issuance of the original card certificate, a provisional first-aid instructor may renew his annual pocket card certificate upon completing the training or retraining of a class of at least six persons connected with the mineral industries whose members have satisfactorily passed an examination given by a Bureau of Mines representative. After five yearly renewals of his provisional instructor's pocket card certificate, an instructor receives a large, engraved, permanent instructor's certificate, as well as a permanent instructor's pocket card certificate.

A mine, plant, or company in the mineral industries that completes training its entire personnel in the Bureau of Mines standard first-aid course receives a large, engraved certificate showing that 100 percent of the employees have been so trained.

FIRST AID

First aid is emergency care of a person who is injured or ill, to prevent death or further injury, to relieve pain, and to counteract shock until medical aid can be obtained.

The imperative need for first aid in many injuries where medical aid is not immediately available makes it the duty

of everyone to be able to give proper assistance until a doctor arrives or the injured person can be taken to a doctor.

Even today, as in its inception, the first-aid instruction given by the Bureau of Mines has its limitations. First aid is never taught to replace the physician or surgeon but only to protect the patient until medical or surgical aid can be obtained. One of the first things taught first-aid men is to send for medical aid in all cases of serious injury, and even in minor injuries to be sure that the patient sees a physician as soon as possible.

First aid, rendered correctly, in many instances can restore natural breathing, usually check loss of blood, prevent or moderate shock, protect wounds and burns from infection, immobilize fractures and dislocations, lessen pain, and conserve the patient's strength; and when medical aid can be obtained, his chance of recovery is greatly enhanced.

The principal objects of first aid are:

- (1) Prevention of further injury.
- (2) Checking conditions known to be endangering life.
- (3) Protecting injuries from infections and complications.
- (4) Making the patient as comfortable as possible to conserve his strength.
- (5) Transporting the patient to medical assistance, where required, in such a manner as not to complicate the injury or subject him to any more discomfort than is absolutely necessary.

Experience of the Bureau of Mines has shown repeatedly that first-aid training is an essential means of promoting safety as well as of saving life. The beneficial influence of the training spreads in many directions.

Importance of First Aid to the Employee

He is trained to care properly for injuries to himself and to others while he is at work, at home, and elsewhere.

He is made safety-minded and less liable to be injured, because the training impresses the factor of personal safety through acquaintance with the dire results of injuries.

He is taught that even the most trivial injuries are potential sources of danger and therefore takes fewer chances of permitting wounds to become infected.

He is stimulated to have due regard for fellow employees, both as to their safety and the proper care of injuries they may receive.

Importance of First Aid to the Employer

Those trained in first aid become safer integral parts of the working force, thus lowering the accident experience rate.

Better care for injured employees at the critical time is afforded in proportion to the number trained and their placement among the working force.

Lost time caused by accidental injuries is reduced and efficiency increased.

Compensation and medical costs are smaller.

Furthermore, experience of the Bureau of Mines has shown that, with 100-percent training of mine personnel in first aid, intermingling of the men, the bosses, and the plant or mine officials in classes where everyone is on a common footing and has a common interest in a humane endeavor creates better feeling and understanding between the men and their employers. It propagates a spirit of mutual protection and regard for the wellbeing of all among the supervisory and working forces.

GENERAL DIRECTIONS FOR FIRST AID

When a person is injured someone should take charge, send for a doctor, and apply first aid. In the past many injured persons have died because no one present was trained to treat them. To prevent such neglect, every employee should acquire a knowledge of first aid and be able to apply it.

The one assuming charge should make a careful but quick examination to determine the nature of the injuries. Find whether breathing is normal, and look for hemorrhage, shock, open wounds and burns, fractures, dislocations, and other injuries. In examining an injured person, do not remove his clothes in the usual way, as you may cause unnecessary suffering and make his injury worse. If the injury is to the arms, legs, or body, cut the clothing from the body, preferably along the seams.

The person in charge should then direct others present how to assist him in caring for the patient, being careful not to attempt any unnecessary movement of the body or limbs. The injured part should be in as normal a position as possible. Fractures and dislocations should be supported and dressed in the line of deformity.

Unless absolutely necessary, do not move the person until you have a clear idea of the injury and have used first aid. If you believe that the injury is serious, that the patient is in a place safe from further injury, and that medical aid can be obtained promptly it is sometimes best not to attempt to move him but to employ such emergency care as is possible until a doctor arrives. This applies particularly when adequate first-aid materials are not at hand for properly immobilizing major fractures.

Be calm and quiet. Keep onlookers from crowding around the patient and shutting off air for breathing. Do not wait for a doctor, as delay often is dangerous. Try to make the patient comfortable by doing whatever is necessary, but no more. Loosen tight clothing, especially about the neck, chest, and waist. If a patient's face is flushed, put something under his head to raise it. If his face is pale,

keep his head on a level with his body. If he vomits, turn his head to one side so that the vomited matter will flow from the mouth and not get into his windpipe and choke him. Remove false teeth, tobacco, gum, or other foreign matter from his mouth, and see that his tongue is forward and not back over his windpipe. Never attempt to give an unconscious person water or any other liquid by mouth, as it may enter his windpipe and strangle him. If the patient is conscious, give him all the water he wants, but give it slowly and in sips.

Frequently it is dangerous to let an ill or injured person sit or stand, and to permit him to walk may cause his death. A seriously injured person always should be kept lying down and covered with blankets, brattice cloth, or clothing. Always place blankets, brattice cloth, or clothing under a patient to exclude cold from the ground. Heated objects, if at hand, should be wrapped and tested against your own skin on the side of your face and, if not too hot, placed next to the body of the injured person under the covering. Always encourage the patient, and keep him hopeful.

If regular first-aid material is not at hand, make your own splints, tourniquets, or stretchers of material near the place of the accident. When there are several injuries, treat the most serious one first, especially if it involves severe loss of blood. Always remember that a first-aid man should not attempt work that should be done by a physician or surgeon.

What a First-Aid Man Should Do

Send for medical aid in all serious injuries.

Have all supposed minor injuries checked by a physician to be sure they have been cared for properly.

Be calm.

Take command, and give orders.

Locate the injury.

Know what to do, and do it.

Keep onlookers away from the patient.

If artificial respiration is indicated, start it without delay.

Use a knife or scissors to remove clothing.

Look for bleeding, and check it (1) by pressing the fingers or thumb on the skin over the blood vessel at the location of the pressure point, (2) by a tourniquet, or (3) by a bandage compress and bandage applied with pressure over the wound.

Treat for physical shock.

Keep the patient lying down.

Cover all wounds completely with a *sterile* bandage compress, or sterile gauze in case of large wounds, and a triangular or cravat bandage, except wounds of the eye, nose, chin, fingers, or toes, where a sterile bandage compress only is used.

Do not allow the fingers or instruments to touch a wound.

Remove any loose foreign objects from a wound with a

piece of sterile gauze, but do not attempt removal if embedded in the wound.

Look for fractures; **never** move a patient, unless absolutely necessary, until splints have been applied.

Leave reduction of dislocations or fractures to a surgeon, except dislocations of jaw, fingers, or toes.

Place a sterile bandage compress and a bandage over a compound fracture without undue pressure before applying splints.

Exclude air from burned surfaces as quickly as possible by using picric-acid gauze or other suitable dressing.

Remember that only part of your work is completed when the patient is ready for the stretcher. Unnecessary or rough handling may undo all your work.

Place the patient on the stretcher carefully, avoiding jerky movements, and carry him to safety. Always test a stretcher before placing a patient on it.

FIRST-AID ORGANIZATION

Making first aid successful and most effective necessitates the interest, cooperation, and unqualified support of all workers, as well as owners, operators, physicians, superintendents, safety engineers, foremen, and assistant foremen.

Owners or operators can assist greatly by providing a convenient meeting room and fitting it with first-aid materials and equipment for training purposes, as well as by keeping a suitable supply of first-aid materials reasonably close to all active working places at all times. Company physicians can aid by arranging lectures and acting as medical advisers in first-aid instruction. Superintendents, safety engineers, foremen, assistant foremen—in fact, all in supervisory authority—can assist by encouraging men to take first-aid training and by attending and participating actively themselves.

The fact must never be forgotten that, to reap the full benefit from first aid, it must extend beyond the actual giving of assistance to injured persons and make itself felt in the larger field of preventing the occurrence of such injuries. It should be kept in mind that a man well-trained in first aid is very likely also to be a good booster for safety in and about a mine or plant.

FIRST-AID EQUIPMENT

Dressing Stations

First-aid dressing stations should be established in all plants and mines at suitable places, convenient to all employees. In large mines it has been found advisable to have first-aid dressing stations underground near the bottom of the shaft or slope or on working levels adjacent good man-

ways. On the surface at a mine, the first-aid dressing station should be near the mine opening or manway.

An emergency dressing station should be equipped with a stretcher, two woolen blankets, a waterproof blanket, a supply of splints, and a good stock of dressings; all supplies should be protected from moisture and air in a sealed metal container or its equivalent and kept reasonably clean. There should also be a supply of individual first-aid packets containing:

- 1 sterilized 40-inch triangular bandage.
- 1 sterilized 2-inch bandage compress.
- 2 sterilized 1-inch bandage compresses.
- 1 square foot of picric-acid gauze, folded.
- 1 inhalant ampoule of aromatic spirits of ammonia.

These dressings should be in germproof wrappings packed in a sealed metal box.

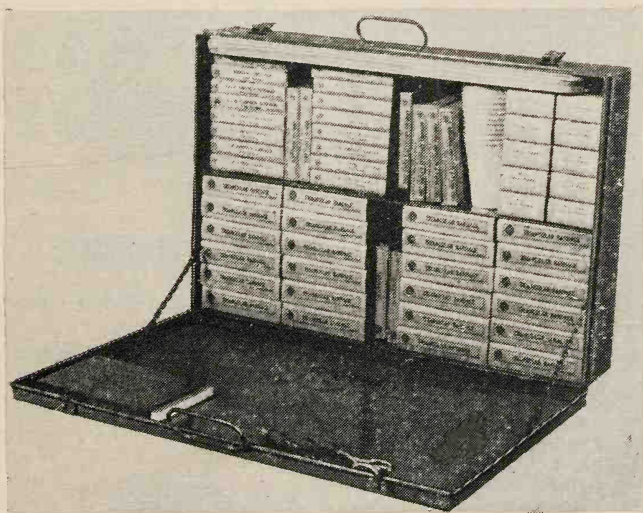


FIGURE 1.—Typical First-Aid Cabinet and Contents.

First-Aid Cabinets

First-aid cabinets with suitable first-aid material (fig. 1) to permit care of all injuries should be distributed about the plant or mine within easy access to employees.

The suggested minimum contents of the first-aid cabinet in unit packages is as follows:

- 24 sterilized, 40-inch, triangular bandages.
- 12 sterilized, 1-inch, bandage compresses.
- 32 sterile, 1-inch, adhesive compresses.
- 16 sterilized, 2-inch, bandage compresses.
- 8 sterilized, 4-inch, bandage compresses.
- 5 packages of sterile gauze, 1 yard square, folded.
- 5 packages of sterile picric-acid gauze, 1 yard square, folded.
- 4 packages of ampoules of aromatic spirits of ammonia for internal use.
- 2 packages of inhalant ampoules of aromatic spirits of ammonia.
- 12 paper cups (open, nested).
- 2 Army tourniquets.
- 1 pair of dressing scissors.
- 1 pair of tweezers.
- 6 splints of yucca or similar material.

Additional material should be placed in first-aid cabinets only on the recommendation of the mine or plant surgeon.

Many mines store combination splints and stretchers throughout the underground workings. These combination units can be constructed at moderate cost and will care for immobilization of many more serious fractures and dislocations, as well as serve the purpose of stretchers. (See illustrations under Transportation, pp. 115 to 117.)

LIST OF FIRST-AID TRAINING MATERIAL

Suggested material required for a class of 20 persons follows:

- 1 set of first-aid charts.
- 40 triangular bandages, made from at least 40-inch sheeting or muslin.
- 24 triangular bandages, 44 inches in long dimension.
- 25 practice bandage compresses, 4-inch size.
- 2 sterile bandage compresses, 4-inch size.
- 2 sterile bandage compresses, 3-inch size.
- 2 sterile bandage compresses, 2-inch size.
- 1 piece of yellow gauze 1 yard square, to simulate picric-acid gauze.
- 1 piece of plain gauze 1 yard square, to simulate sterile gauze.
- 3 pieces of canvas or brattice cloth, 1 yard by 2 yards, for floor covering.
- 2 Army-type tourniquets.
- 8 single blankets.
- 1 Army-type stretcher. (Where several classes are being held at the same location, a single stretcher may serve the classes.)
- 2 pieces of pipe, 1 by 84 inches.

Splints

Number of pieces:	Size, inches
4.....	12 x 4 x $\frac{1}{4}$
4.....	22 x 4 x $\frac{1}{4}$
4.....	30 x 4 x $\frac{1}{2}$
4.....	84 x 12 x $1\frac{1}{2}$
2.....	84 x 6 x 1
6.....	22 x 4 x $1\frac{1}{2}$
4.....	68 x 6 x 1
4.....	12 x 4 x $\frac{1}{2}$

Splint assemblies

<i>Dislocations</i>	<i>Number of pieces</i>	<i>Size, inches</i>
Elbow, L-shaped splint.....	$\left\{ \begin{array}{l} 1 \\ 1 \end{array} \right.$	$\left\{ \begin{array}{l} 12 \times 4 \times \frac{1}{4} \\ 22 \times 4 \times \frac{1}{4} \end{array} \right.$
Elbow, straight.....	1	30 x 4 x $\frac{1}{2}$
Hip.....	1	84 x 12 x $1\frac{1}{2}$
Knee, kneecap, or ankle: Same as for fracture of thigh, knee, leg, or ankle. See following.		
<i>Fractures</i>	<i>Number of pieces</i>	<i>Size, inches</i>
Lower two-thirds of arm, elbow, forearm, and wrist.	Same as for dislocation of elbow, L-shaped splint. See above.	-----
Fracture or crushing of hand or fingers.	Same as long section, dislocation of elbow, L-shaped splint. See above.	-----
Fracture of spine	$\left\{ \begin{array}{l} 2 \\ 3 \end{array} \right.$	$\left\{ \begin{array}{l} 84 \times 6 \times 1 \\ 22 \times 4 \times 1\frac{1}{2} \end{array} \right.$
(May be used for dislocation of hip or fracture of pelvis.)		
Fracture of pelvis.....	Same as for dislocation of hip. See above.	-----
Fracture of thigh, knee, kneecap, leg, or ankle.	1.....	68 x 6 x 1
Fracture or crushing of foot or toes.	1.....	12 x 4 x $\frac{1}{2}$

Chapter II. ANATOMY OF HUMAN BODY

To understand the reasons for many first-aid procedures and to render intelligent and efficient first aid, it is necessary for those taking first-aid training to know something about the anatomy (structure) and physiology (work) of the human body and its more important organs. The body is composed of solids (bones and tissues) and fluids (blood and secretions of various organs and membranes).

The human body is divided into three parts:

1. The head, made up of the skull (a bony case that encloses and protects the brain) and the face.

2. The trunk—the main part of the body—is divided into two parts by a muscular partition known as the diaphragm. The upper portion of the trunk is the chest, its cavity and organs. The lower portion is the abdomen, its cavity and organs.

3. The extremities: The upper extremity on each side consists of the shoulder joint, the arm, the forearm, the wrist, and the hand. The lower extremity on each side consists of the hip joint, the thigh, the leg, the ankle, and the foot.

THE SKELETON

The adult human skeleton (fig. 2) is composed of approximately 200 bones, which are classified according to shape as long bones, short bones, flat bones, and irregular bones. The skeleton forms a strong but flexible framework for the body, supports and carries the soft parts, protects vital organs from injury, gives attachment to muscles and tendons, and forms joints so that movements are possible.

Head

The head is composed of 22 bones, 8 of which are closely united to form a bony case—the skull—which encloses the brain; 14 other bones enter into the formation of the face. The only movable bone in the head is the lower jaw.

Trunk

The trunk is composed of 54 bones. The spinal column or backbone in the adult consists of 26 segments, called vertebrae, joined by strong ligaments to form a flexible column that encloses the spinal cord. The chest is formed by 24 ribs, 12 on each side, which are attached in the back to vertebrae or segments of the spinal column. The 7 upper ribs are attached in front to the breastbone by means of cartilage. The next 3 ribs are attached in front by a common cartilage to the seventh or rib above instead of to the breastbone. The lower 2 ribs, known as the floating ribs, have no attachments in front.

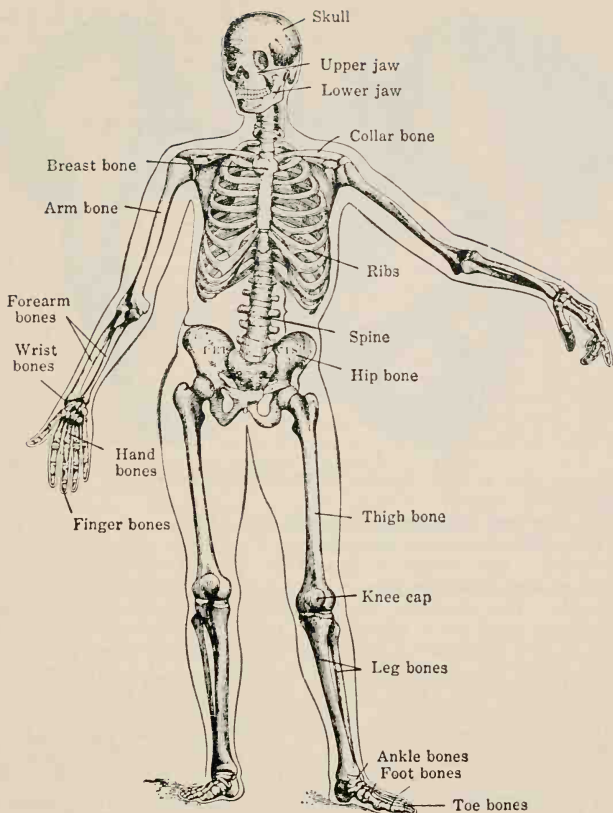


FIGURE 2.—The Skeleton.

Pelvis

The pelvis is the basin-shaped bony structure at the lower portion of the trunk; it is between the movable vertebrae of the spinal column or backbone, which it supports, and the lower limbs, upon which it rests. The pelvis is composed of 4 bones: The 2 lower bones of the backbone and the winged-shape hip bones on either side. It forms the floor of the abdominal cavity and provides deep sockets into which the heads of the thigh bones fit (*see fig. 3*).

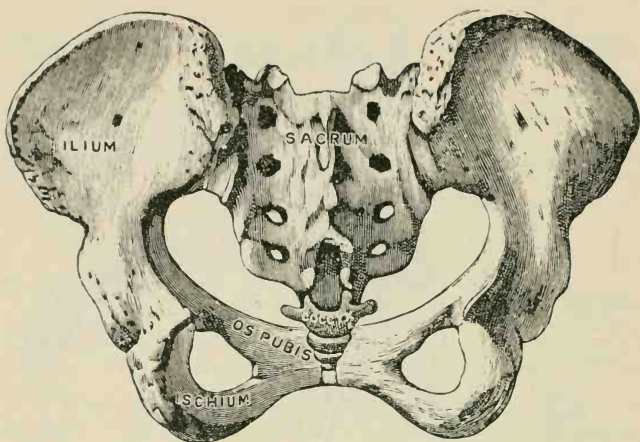


FIGURE 3.—The Pelvic Basin.

Extremities

Each upper extremity consists of 32 bones:

The collarbone—a long bone, the inner end of which is fastened to the breast bone and the outer end to the shoulder blade at the shoulder joint—lies just in front of and above the first rib. The shoulder blade—a flat, triangular bone—lies at the upper and outer part of the back of the chest and forms part of the shoulder joint. The arm bone extends from the shoulder to the elbow and the two bones of the forearm from the elbow to the wrist. There are 8 bones of the wrist that form the heel of the hand, 5 bones in the palm of the hand, and 14 bones of the fingers (2 in the thumb and 3 in each finger).

Each side of the lower extremities consists of 30 bones:

The thigh bone, the longest and strongest bone in the body, extends from the hip joint to the knee; its upper end is rounded to fit into the socket in the pelvis and the lower end broadens out to help form the knee joint. The kneecap, a flat, triangular bone, is in front of the knee joint. Two bones in the leg extend from the knee joint to the ankle. There are 7 bones of the ankle or back part of the foot, 5 long bones of the front part of the foot, and 14 bones of the toes.

The majority of fractures and dislocations occur to the bones of the extremities.

JOINTS AND LIGAMENTS

Two or more bones coming together form a joint. There are several types of joints, immovable, such as bones in the

head, and movable. First aid is concerned mostly with movable joints, which are those commonly dislocated. The ends of bones forming a movable joint are covered by cartilage, and the bones are held in place by strong white bands, called ligaments, extending from one bone to another and entirely around the joint. A smooth membrane that lines the end of the cartilage and the inside of the ligaments secretes a fluid that keeps the joints lubricated. Sprains result from stretching or tearing of the ligaments or other tissues around a joint.

MUSCLES AND TENDONS

Bones, the framework of the body, are mostly covered with flesh and muscle tissue which give the body its shape and contour. The fibers forming the muscles are bound together in bundles of different length, breadth, and thickness. Bundles of muscle tissue can shorten, lengthen, or thicken, by which means movements of the various parts of the body are made possible. There are two types of muscles—voluntary (those we control, such as muscles moving the arms, legs, etc.) and involuntary (those we do not control, such as muscles of the heart, digestion, breathing, etc.).

Tendons are the strong, fibrous cords that attach muscles to the bones. They are inelastic; but the power of contraction or extension of the muscles, to which they are attached, causes the bones forming joints to move either by flexing or extending.

Overstretching of a muscle or tendon results in a strain, a frequent type of injury.

THE SKIN

The skin is the protective covering of the body; it also contains the sweat glands, which aid greatly in regulating body temperature. The skin consists of two layers, an external layer (epidermis) and a deeper layer or true skin (dermis).

THE CHEST CAVITY AND ITS CONTENTS

The chest cavity (fig. 4) is cone-shaped and is formed by the upper part of the spinal column or backbone at the back; the upper eight ribs on the sides; and the ribs and breast bone in front. The thin, muscular partition at the bottom, the diaphragm, separates the chest cavity from the abdominal cavity. The diaphragm is dome-shaped, reaching a lower level in the back than in the front.

The lungs and the heart occupy most of the chest cavity. The heart lies between the lungs, mostly on the left side, making the left lung smaller than the right. Besides the heart and the lungs, the chest cavity contains the food pipe (esophagus), the windpipe (trachea), and several large blood vessels.

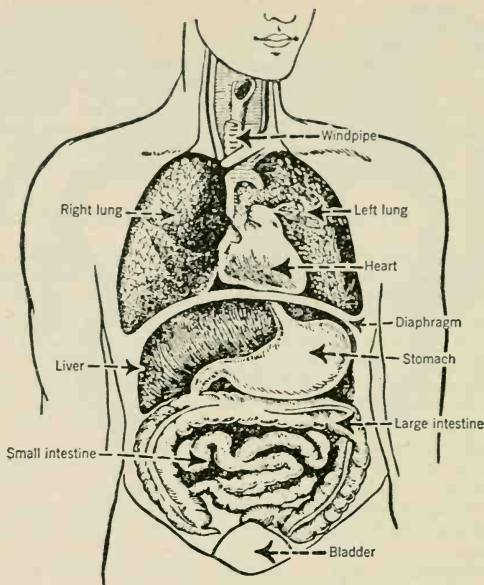


FIGURE 4.—The Chest and Abdominal Cavities and Their Contents.

THE ABDOMINAL CAVITY AND ITS CONTENTS

The abdominal cavity (fig. 4) is the lower portion of the trunk, plus the lower portion of the backbone and back muscles in the back and the four lower ribs and abdominal muscles on the sides and front. The diaphragm forms the top of the cavity and the pelvic basin the bottom.

The abdomen contains many important organs: The liver in the upper right, entirely under the ribs; the stomach in the upper left; the small and large intestines in the lower portion of the abdominal cavity; the kidneys, one on each side, high up in the back; and the urinary bladder just back of the front of the pelvis where it is frequently injured from a fractured pelvis. There are also large blood vessels and other organs in the abdominal cavity.

EXCRETORY SYSTEMS

The waste products that enter or are formed within the body are eliminated by several different systems. The residue of food taken into the digestive system, mainly indigestible materials, together with secretions from various glands emptying into the intestines, is gathered in the lower portion of the large intestines—the rectum—and eliminated as feces.

Excess water carrying dissolved salts either in excess in the system or formed as waste products is secreted by the kidneys, collected in the bladder, and expelled as urine.

Carbon dioxide and certain volatile products carried by the blood are exchanged in the lungs for oxygen and pass from the body in exhaled air.

The skin contains many small organs known as sweat glands. They range in number from 400 to 2,800 per square inch, according to position, over the body surface. These glands play an important part in eliminating body heat and excess fluid and dissolved waste products from the body.

Life and health depend on the body throwing off its waste products; interference with or lessening of normal functioning of any of the excretory systems results in illness and may even cause death.

Chapter III. FIRST-AID DRESSINGS

First-aid dressings are triangular bandages that can be used either open or folded into cravat bandages, as required, sterile bandage compresses, sterile gauze, picric-acid gauze, tourniquets, and splints.

BANDAGES

A bandage is used to cover wound and burn dressings, to make improvised tourniquets, to support fractures and dislocations, to apply splints, and to form slings. If a regular-size bandage is found to be too short when a dressing is applied, it can be lengthened by tying a piece of another bandage to one end.

TRIANGULAR BANDAGES

The triangular bandage (fig. 5) is recommended by the Bureau of Mines because it is applied easily and can be handled by a first-aid man in such a way that the part applied over wound or burn dressings will not be soiled and it does not tend to slip off when once applied correctly. It is usually made from unbleached cotton cloth, although any kind of cloth will answer the purpose. In emergencies a triangular bandage can be improvised from a clean handkerchief or clean piece of shirt. A standard triangular bandage is made from a piece of cloth 40 inches square by folding the square diagonally and cutting along the fold.

CRAVAT BANDAGES

A triangular bandage may be used in two forms, open and folded, as shown in figure 5; when folded, it is known as a cravat. To prepare a cravat bandage, make a $1\frac{1}{2}$ -inch fold along the base of the triangular bandage, then bring the apex to the center of the base, placing the apex underneath the fold; this makes a wide cravat bandage. The bandage may be divided again by folding lengthwise along a line midway between the base and the new top of the bandage; this makes a medium cravat bandage. If folding is repeated, a narrow cravat bandage is made.

This method has the advantage that all bandages can be folded to uniform width, or the width may be varied to suit the purpose for which it is to be used. To complete a dressing the ends of the bandage are tied together securely. Knots should be placed where they do not cause discomfort and where they may be reached easily.



FIGURE 5.—Method of Folding Cravat Bandages.

A, Hem folded along base; B, apex placed under the hem, wide cravat bandage; C, medium cravat bandage; D, narrow cravat bandage.

REEF OR SQUARE KNOT

Unless otherwise specified, all knots or ties mentioned in this Manual should be reef or square knots.

To Tie a Reef or Square Knot—Take an end of the bandage in each hand, pass the end in the right hand over the end in the left hand, and tie a single knot. Then pass the end now in the left hand over the end in the right hand, and complete the knot. The free ends after the second knot are in the same place as the ends after the first knot. The rule to remember in tying a square knot is right over left, then left over right.

This knot can be untied easily by converting it into a slip knot. Grasp one tail of the bandage in one hand, hold the bandage with the other hand, and pull the tail until the knot rolls. Release the tail, and with the free hand grasp the knot, holding it firmly; with the other hand, pull the bandage away from the knot.

BANDAGE COMPRESS

A bandage compress is a special dressing to cover open wounds. It consists of a pad made of several thicknesses of sterile gauze sewed to the middle of a strip of muslin. Three sizes are used—small, medium, and large. Bandage compresses come folded so that the sterile gauze pad can be applied directly to the open wound with virtually no exposure to the air or fingers. The strip of muslin at either side of the sterile gauze pad is folded back; it can be opened up and the bandage compress tied in place with no disturbance of the sterile-pad application. The gauze of a bandage compress may be extended to twice its normal size by ripping the stitching on one side and opening up the folded gauze. Unless otherwise specified, all bandage compresses and all gauze dressings must be covered with open triangular or cravat bandages.

GAUZE

Two kinds of sterile gauze—plain and picric acid—are used at various times in applying first-aid dressings; plain sterile gauze may be used in place of a bandage compress to cover large wounds. If plain sterile gauze is required and is not available, it may be procured by loosening the stitches on the back of a large bandage compress, tearing off the gauze, and fluffing it after removal from the muslin strip of the bandage compress. Care should be taken not to touch the portion of the gauze that is to be placed directly in contact with the wound. Sterile picric-acid gauze has been treated with a solution of picric acid; it is used for dressing burns. For other types of dressing for burns, *see Burns* (p. 72). Both plain sterile gauze and sterile picric-acid gauze usually are obtained in packets containing 1 square yard of gauze, folded.

SLINGS

Slings are used to support injuries of the shoulder, arm, elbow, forearm, wrist, hand, or fingers. In an emergency they may be improvised from belts, ties, handkerchiefs, or similar material, but bandages should be used if available.

TRIANGULAR-BANDAGE SLING

Place one end of the base of an open triangular bandage over the shoulder of the injured side, allowing the bandage to hang down in front of the chest so that the apex will be behind the elbow of the injured arm (fig. 6, A); bend the arm at the elbow, thus bringing the forearm across the chest over the bandage. Then carry the lower end of the bandage

over the shoulder of the uninjured side and tie at uninjured side of the neck. Twist the apex of the bandage, and tuck it in at the elbow. The fingertips should be exposed so as to permit detection of interference with circulation.

CRAVAT-BANDAGE SLING

In making a cravat-bandage sling, place the center of a medium or narrow cravat bandage under the injured person's wrist and part of the hand, the inner end passing over the shoulder of the injured side and the other end passing over the shoulder of the uninjured side (fig. 6, *B*). Tie at the uninjured side of the neck.

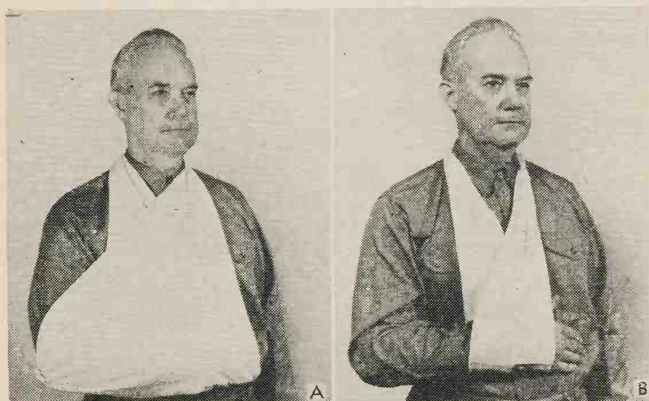


FIGURE 6.—Arm Slings:

A, Triangular-bandage sling; *B*, cravat-bandage sling.

BASKET SLING

A useful sling for use on an unconscious victim, particularly for transportation or handling, can be made with an open triangular bandage as follows:

Place an open triangular bandage across the chest with the apex down, fold arms over one another on the bandage, bring base ends together, and tie; cross apex over folded arms, and tie to knotted ends of base (fig. 7).

TOURNIQUETS

A tourniquet is an appliance used to check severe bleeding from an artery. If a regularly constructed tourniquet is not at hand, one can be improvised from a strap, belt, sus-

penders, handkerchief, towel, bandage, necktie, piece of brattice cloth, rubber tubing, or other suitable materials. Never use wire, cord, or anything that will cut into the flesh. The application of tourniquets will be discussed in detail in connection with the control of bleeding (p. 41).

SPLINTS

Splints are used to support and protect injured parts, such as fractures, dislocations, or suspected broken bones, and to prevent movement at the point of fracture and at the nearest joint. They must be of stiff material. Improvised splints may be made from pieces of wood, broom, pick, or shovel handles, mine augers, drills, rules, laths, heavy cardboard, canes, umbrellas, sprags, cap boards, newspapers, magazines, or other similar material.



FIGURE 7.—Dressing for Tying Together Arms of an Unconscious Patient for Transportation.

Chapter IV. ARTIFICIAL RESPIRATION; ELECTRIC SHOCK; DROWNING; SUF- FOCATION; DANGEROUS GASES

ARTIFICIAL RESPIRATION

Respiratory System

Oxygen is essential to human life, and all living tissue depends for life on the oxygen carried by the blood. As oxygen enters the body by breathing, any interference with or stoppage of breathing produces oxygen want or asphyxiation throughout the entire body. Knowledge of the respiratory system and the organs concerned with respiration will greatly aid in understanding artificial respiration.

Respiration is breathing by which air is taken into the lungs during inspiration and forced out during expiration. In passing to and from the lungs the air passes through the nose, the throat, and the windpipe. In the nose the air is warmed and moistened. By means of the moist hairs and the moist mucous membrane of the nose, much of the dust in breathed air is filtered out. Moreover, the sense of smell, which warns of the presence of some harmful gases, is situated in the nose.

The throat is a continuation of the nose and mouth; at its lower end are 2 openings, 1 in front of the other. The one in front is called the trachea or windpipe and leads to the lungs. The one behind is called the esophagus or foodpipe and leads to the stomach (*see fig. 8*).

At the top of the windpipe is a flap, the epiglottis, which closes over the windpipe during swallowing to prevent food or liquid from entering it. When a person is insensible or unconscious the flap may fail to act; therefore, no solids or liquids should be given by mouth, as they may enter the windpipe and cause strangulation. The tongue of an unconscious person, especially if he is lying on his back, is apt to fall back on the epiglottis or flap over the windpipe and prevent air from reaching the lungs. Always see that the tongue is pulled forward when a person is unconscious or breathing is difficult.

The windpipe extends into the chest cavity, where it divides into the 2 bronchial tubes, 1 going to each lung. After the tubes enter the lungs they keep dividing and re-dividing, like limbs of a tree, until they become very small.

Lungs

The lungs are two cone-shaped bodies that are soft, spongy, and elastic. The outside of each lung is covered by a closed sac called the pleura. The inner part of the lungs communicates freely with the outside air through the windpipe.

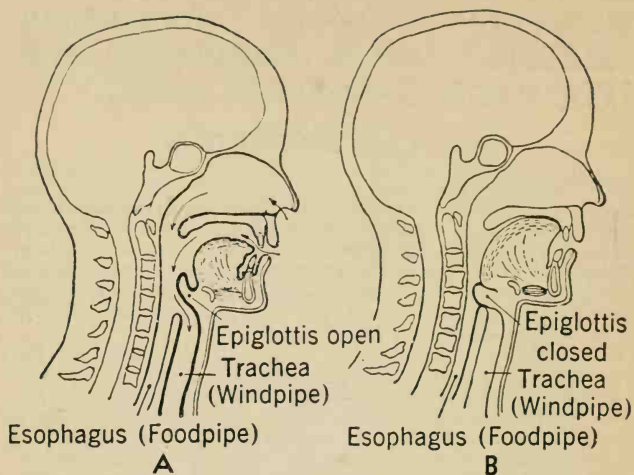


FIGURE 8.—Nose, Throat, Trachea, and Esophagus With:
A, Epiglottis open; B, epiglottis closed.

The outside of the lungs is protected from air pressure by the walls of the chest cavity, creating a lessened pressure within the enveloping lung sac. The air pressure within the lungs expands them until they fill almost the entire chest cavity.

If any air gets through the chest wall or if the lung is punctured so that air from the outside can communicate with the pleural sac, the lungs shrink because the air pressure is equalized outside and inside the chest cavity.

After subdividing into very small branches, the bronchial tubes end in a group of air cells resembling a bunch of grapes, except that they are many times smaller. Around each air cell, which has very thin walls, is a fine network of small blood vessels or capillaries. The blood in these capillaries gives up the carbon dioxide and other waste matter brought from tissue activity all over the body through the thin air-cell wall and in exchange takes on a supply of oxygen from the air breathed into the air cells. The discarded carbon dioxide and waste matter pass from the air cells in air breathed out of the lungs.

Breathing is an act over which we exert little control. It occurs in the healthy adult from 12 to 15 times a minute when he is at rest, but the rate per minute may be increased by exercise, labor, and a number of other causes. The amount of air entering and leaving the lungs during each

respiration varies, as does the rate of breathing, according to whether the person is at rest or engaged in work or exercise. At rest adults breathe 25 to 30 cubic inches of air per respiration, whereas during strenuous effort the amount may be increased several times that breathed when at rest.

Breathing consists of two separate acts—inspiration, an enlargement of the chest cavity with a lowering of the pressure within the cavity, during which air is drawn into the lungs; and expiration, a lessening of the chest cavity and increasing of the pressure within the cavity, during which air is driven out of the lungs. In inspiration, which is chiefly a muscular act, the ribs are raised, and the arch of the diaphragm falls and becomes flattened, increasing the capacity of the chest cavity and tending to produce a vacuum, causing air to enter. In expiration, an act performed with slight muscular action, the ribs fall to their normal position, the arch of the diaphragm rises (lessening the capacity of the chest cavity), and air is forced out.

PRINCIPLES OF ARTIFICIAL RESPIRATION

Artificial respiration is a method by which normal respiration is imitated, by manual movements, to induce breathing in persons whose respiration has stopped. As we have no means of influencing muscular action in an unconscious person to produce normal inspiration, we have to depend on manual means of forcing air from the lungs by compression and on the natural elasticity of the walls of the chest cavity plus the drop of the arch of the diaphragm to draw fresh air into the lungs when the compression is released, as in the prone-pressure method; also, by pressure on the back or chest, to force air out of the lungs and induce it into the lungs by raising the arms to move the muscles of the chest walls.

Where breathing has stopped or is very irregular and feeble, artificial respiration is usually required. The most frequent conditions under which artificial respiration is required are electric shock, gas poisoning, drowning, and suffocation from various causes.

In many conditions where breathing has ceased, or apparently ceased, the heart action continues for a limited time. If fresh air is brought into the lungs, so that the blood can obtain the needed oxygen from the air, life can be sustained. This can be accomplished in many instances by artificial respiration.

Certain general principles must always be kept in mind in applying any method of artificial respiration.

Time is of prime importance; seconds count. Do not take time to move the victim to a more satisfactory place unless the place is unsafe for victim or rescuer; **begin at once**. Do not delay resuscitation to loosen the victim's clothes, warm

him, apply stimulants, etc. These are secondary to the main purpose of getting air into the victim's lungs.

If at all possible, incline his body slightly to permit better drainage of fluid from the respiratory passage.

As soon as artificial respiration has been started and while it is being continued, an assistant should remove from the victim's mouth all foreign bodies, such as false teeth, tobacco, gum, and any loose material; see that the tongue is forward and not over the windpipe; and loosen any tight clothing about the victim's neck, chest, or waist.

Keep the victim warm, by covering him with blankets, clothing, or other material; if possible, his underside should also be covered. Place hot-water bottles, hot bricks, or other heated objects, well-wrapped in cloth or paper and tested to prevent burning the victim, about him.

Continue artificial respiration rhythmically and uninterruptedly until spontaneous breathing starts or a doctor pronounces the patient dead.

If the victim begins to breathe of his own accord, adjust your timing to his. Do not fight his attempt to breathe.

A brief return of natural respiration is not a signal for stopping the resuscitation treatment. Not infrequently a patient, after a temporary recovery of respiration, stops breathing again. He must be watched; if natural breathing stops, resume artificial respiration at once.

Always treat the victim for shock during resuscitation, and continue such treatment after breathing has started. Do not give any liquids whatever by mouth until a patient is fully conscious.

If it is necessary (due to extreme weather or other conditions) to move a patient before he is breathing normally, continue artificial respiration while he is being moved.

TREATMENT AFTER RECOVERY

To avoid strain on his heart, keep the patient prone, and do not allow him to sit up or stand after he revives. If he must be moved, carry him on a stretcher. To avoid additional strain on the heart, turn him over on his back when breathing becomes regular.

After the victim is revived and conscious, slowly give him a stimulant, such as 1 teaspoon of aromatic spirits of ammonia in half a glass of water or a hot drink of coffee, tea or water.

Keep the patient warm, and continue to treat him for shock.

METHODS OF MANUAL ARTIFICIAL RESPIRATION

There are several methods of giving manual artificial respiration, as well as a combination of methods, all effective,

but in some methods more air is forced into the lungs than others; moreover some methods are more difficult to teach and more tiring to the operator.

The Bureau of Mines recommends three methods: (1) The Holger-Nielsen (back-pressure arm lift), (2) the Silvester, and (3) the Schafer (prone-pressure). The Holger-Nielsen (back-pressure arm lift), which gives the greatest exchange of air in the lungs, is now the preferred method and should be used wherever possible. However, when a victim has severely injured arms that cannot be raised, this method cannot be employed. Under such circumstances, use the Schafer method. Where a victim is injured in such a way that he cannot be placed on his belly or has severe back injuries, use the Silvester method.

HOW TO GIVE ARTIFICIAL RESPIRATION BY HOLGER-NIELSEN (BACK-PRESSURE ARM-LIFT) METHOD

Position of Victim and Operator

Place the victim face down, with his elbows bent and his hands placed (one upon the other) under his head. Turn his head slightly to one side, with his cheek on his hand (fig. 9, A).

Kneel on the right knee, the left knee, or both knees. If on both knees, kneel facing the victim, one knee on either side and just above the head of the victim. If on one knee, it should be close to the victim's forearm and the foot near the elbow of his other arm. Place the hands flat on the victim's back, just below the shoulder blades, with the tips of the thumbs just touching and the fingers spread downward and outward (fig. 9, A).

Compression Phase

Rock forward until the arms are approximately vertical, allowing the weight of the upper part of the body to exert slow, steady, even pressure downward upon the hands, keeping the elbows straight and exerting pressure almost directly downward on the victim's back. This forces air out of the lungs (fig. 9, B).

Expansion Phase

Release the pressure, avoiding a final thrust; then rock back slowly. Next place the hands upon the victim's arms just above the elbows, drawing them toward you, applying just enough lift to feel resistance and tension of the victim's shoulders. Keep the elbows straight, and when rocking backward, draw the victim's arms toward you. Then lower them gently to the ground (fig. 9, C and D). This completes a full cycle; repeat it 12 times a minute at a steady, uniform rate of compression and expansion, a complete respiration in 5 seconds.

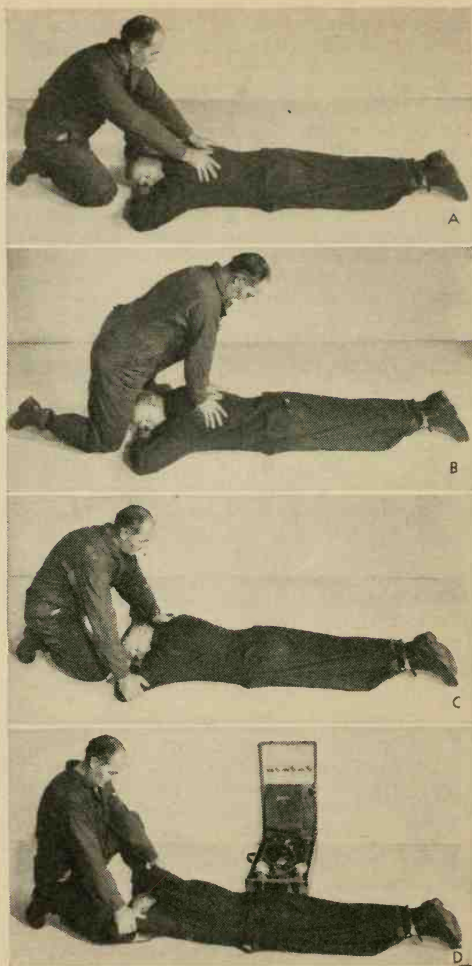


FIGURE 9.—Holger-Nielsen (Back-Pressure Arm-Lift) Method of Artificial Respiration:
A, Position of victim and operator; *B*, compression phase; *C*, start of expansion phase; *D*, completion of expansion phase, oxygen inhaler shown.

Changing Operators in Holger-Nielsen Method

In performing artificial respiration for long periods, the operator becomes tired, making it necessary to relieve him.

There are a number of ways to make this change properly, yet it should always be done in a manner that will avoid any change in the rhythm of the stroke; and, if possible, about the same pressure should be maintained on the victim.

One suggested method follows:

The relief operator kneels on one knee beside the operator and the patient, facing the operator. He swings sideways in unison with the operator, picking up the rhythm of the stroke. This should be done for 3 or 4 strokes.

Then, at a prearranged signal and at the end of a stroke (which, with the Holger-Nielsen method, is when the arms of the victim are lowered to the floor) the operator swings to one side out of the way.

The relief operator, resting on one knee, swings into place with his hands in the proper position on the back of the patient. He is now ready to swing forward in the compression phase of the cycle and to continue the treatment.

Practice may be required to make this change smoothly and efficiently.

HOW TO GIVE ARTIFICIAL RESPIRATION BY SILVESTER METHOD

Place the patient on his back, and remove from his mouth all foreign bodies, such as false teeth, tobacco, and gum. Hold his tongue forward; otherwise, it will fall back and block the windpipe. Grasp it in a dry cloth or pincers. Have someone hold it forward, or better, hold it with a bandage or rubber band over the tongue and under the jaw. Place a rolled-up coat, a pad, or something else of the same shape and size under the patient's shoulders; this will straighten his windpipe. Kneel just above the patient's head, and grasp both his arms at the back of the wrists. Draw the arms outward and upward gently and steadily, and hold them as far as they will go above the head (fig. 10, *A*). This operation requires about 2 seconds, and the motion opens and expands the chest to the greatest possible extent; certain muscles are attached to both arms and ribs, and when the arms are raised these muscles raise the ribs and so enlarge the chest. Then bring the arms down until the elbows press against the chest, forearms crossed; with moderately increasing pressure, diminish the size of the elastic chest (fig. 10, *B*). This movement also requires about 2 seconds. Continue these motions 12 to 15 times per minute. When done properly, this treatment is hard work for the operator, and he should be relieved by someone else as soon as he grows tired. A change of operators should be made at the end of a decompression stroke.

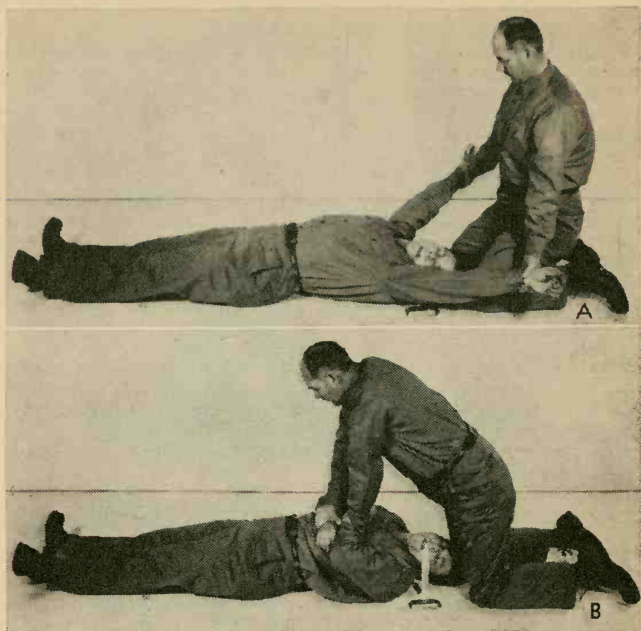


FIGURE 10.—Artificial Respiration, Silvester Method:
A, Inspiration; B, expiration.

HOW TO GIVE ARTIFICIAL RESPIRATION BY SCHAFER (PRONE-PRESSURE) METHOD

Lay the patient face down, one arm extended directly over the head, the other bent at the elbow, and turn his head toward the extended arm so the side of his face will rest on the hand or forearm of the bent arm, and his nose and mouth will be free for breathing (fig. 11, A).

Kneel, straddling the patient's thighs with your knees such a distance from the hip bones as will allow you to place the palms of the hands on the small of the back with the fingers resting on the ribs, the little finger just touching the lowest floating rib, the thumb and fingers in a natural position, and the tips of the fingers just out of sight on the sides of the trunk (fig. 11, B). If conditions make it impracticable to straddle both thighs, assume a position where but one thigh is straddled.

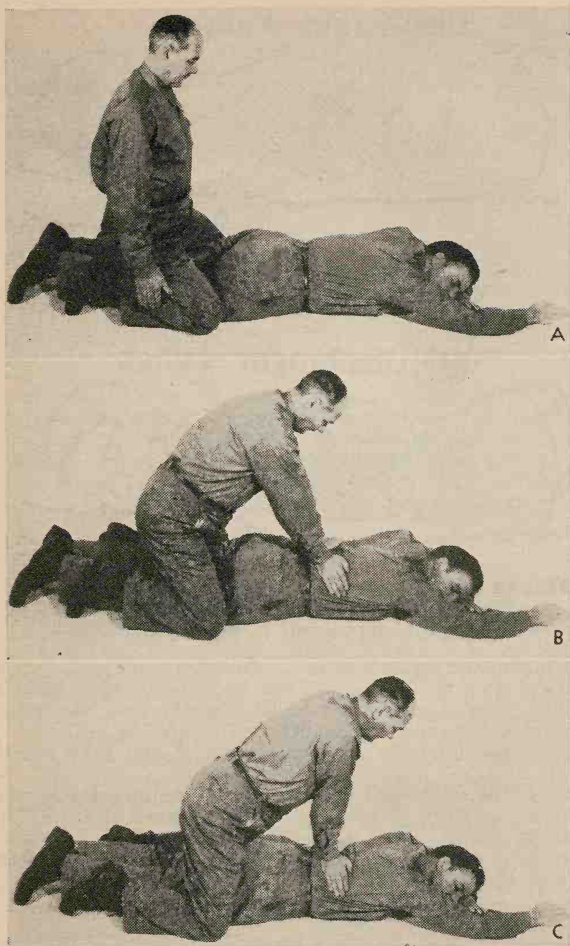


FIGURE 11.—Artificial Respiration, Schafer (Prone-Pressure) Method:

A, Patient prone, operator in position; *B*, inspiration;
C, expiration

NOTE.—Arms are straight at end of expiration stroke to form vertical lines between shoulders and heel of hands.

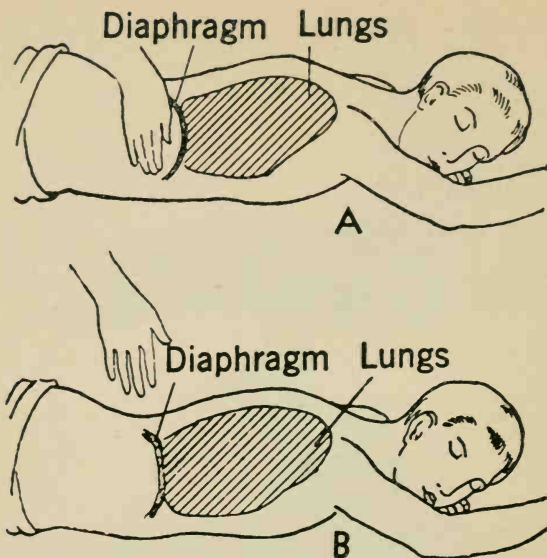


FIGURE 12.—Chest Cavity and Lungs in Prone-Pressure Method of Artificial Respiration:
A, Compressed; B, expanded.

With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the patient. The shoulder should be directly over the heel of the hand at the end of the forward swing (fig. 11, C). Do not bend the elbows. This operation should take about 2 seconds.

Now swing backward immediately to remove the pressure completely. After 2 seconds swing forward again. Thus, repeat 12 to 15 times a minute the double movement of compression and release (fig. 12, A and B), a complete respiration in about 4 seconds.

Changing Operators in Schafer Method

There are several effective methods of changing operators; that adopted by the Bureau of Mines is as follows:

The relief operator kneels beside the patient and swings forward and backward in unison with the person giving artificial respiration. At a prearranged backward or decompression stroke, the operator swings off the patient on the opposite side from the relief operator, and the relief operator

swings into position straddling the patient's thighs to make the next expiration or compression stroke. With a little practice this change can be accomplished within the 2 seconds of decompression without confusion or breaking the regular rhythm.

ADMINISTRATION OF OXYGEN

It is advisable to supplement artificial respiration by administering oxygen, especially when the quantity of fresh air supplied to the patient by artificial respiration is inadequate, as is likely if the patient has been breathing poisonous gases. However, no time should be lost waiting for oxygen before artificial respiration is begun. When oxygen is administered, the manual treatment should not be stopped but should continue as long as there is hope of reviving the patient or until he begins to breathe normally. Oxygen frequently is available in compressed form in an oxygen bottle or cylinder. The valve should be opened slightly, with the flow directed away from the patient. After a moderate flow has been established, the oxygen should be directed past his nose. A cap, hat, or piece of cloth may be used as an improvised mask to confine the oxygen to the face of the patient; an oxygen inhaler (fig. 9, D) aids in its administration.

ELECTRIC SHOCK

Electricity causes shock by paralyzing the nerve centers that control breathing or by stopping the regular beat of the heart. Accidents from electricity are common in and around mines. Any electric current is likely to be dangerous.

The symptoms of electric shock are sudden loss of consciousness, absence of respiration (which, if present, is slight and cannot be detected), weak pulse, and probable burns. When necessary, rescue the person as quickly as possible, being careful not to get in contact with the live wire or other conductor. If a switch is near, turn off the current, but lose no time in looking for one.

Every second of delay in removing a person from contact with an electric current lessens the chance of resuscitating him. Act quickly, but always in such a way that you are protected from contact. Stand on a dry board, thick, dry paper, or cloth; wrap one hand with a dry coat, cap, or other nonconducting material; and with the other hand behind your back drag the person from contact. If both hands must be used, see that they are insulated.

Another way is take a belt, handkerchief, or coat, if it is dry, or a piece of dry rope and loop it over the victim's foot or head if he is lying on the wire, and thus pull him off. If an ax is near at hand, use it to cut the wire, but first make sure that the handle is dry, or wrap it with a coat or other

dry, nonconducting material. A dry board, dry cloth, or dry rope may also be used to pull the wire from the patient. In all cases, remove the wire from the man or the man from the wire promptly; and, if he is not breathing, start artificial respiration at once.

DROWNING

Remove a victim of drowning from water as quickly as possible, and start artificial respiration immediately.

Drowning is a simple form of asphyxia, as the supply of air to the lungs is cut off completely under water. However, this does not mean immediate lack of oxygen, as there is a certain reserve supply in the air cells of the lungs, in the blood, and probably in the tissues that should maintain life for a short time. The amount of reserve oxygen varies; 5 minutes under water sometimes produces death, and life usually is extinct after 10 minutes' submersion.

It is important to start artificial respiration as soon as a drowning victim is removed from the water. Expulsion of air by artificial respiration tends to remove any water in the lungs, and care should be taken that the nose and mouth are low and unobstructed to prevent the water from reentering the air passages.

SUFFOCATION OR ASPHYXIATION

Always rescue a suffocation victim as quickly as possible. He becomes unconscious, his lips and ear lobes become blue, his pulse and breathing stop, and his pupils become dilated. The cause may be something blocking the windpipe and preventing the air from getting into the lungs, or inhalation of harmful gases. A rescuer should exercise due care to protect himself. Unless the air is good get the victim to pure air immediately, and begin artificial respiration at once.

DANGEROUS GASES

Several noxious and toxic gases encountered in the mining, metallurgical, petroleum, and allied industries, as well as in everyday life, cause asphyxia or cessation of breathing; although the occurrence of these gases and their physiological effects on the human system vary greatly, many lives have been saved by prompt and efficient use of artificial respiration.

These gases include carbon dioxide, sulfur dioxide, oxides of nitrogen, ammonia, hydrogen sulfide, carbon monoxide, hydrogen cyanide gas, and cyanogen compounds. Detailed information regarding the properties and physiological effects of mine gases is given in Bureau of Mines Miners' Circular 33.²

² Forbes, J. J., and Grove, G. W., *Mine Gases and Methods for Detecting Them: Miners' Circ. 33*, 1948, 67 pp.

PREVENTING GAS POISONING

The chief factors in preventing poisoning by various toxic or noxious gases that may occur in mines or plants are:

Good ventilation, to dilute and carry away the gases.

Avoidance as much as possible of exposure to air known to contain poisonous gases.

Use of adequate protective equipment when atmospheres known to contain poisonous gases are to be entered. Information on protective equipment against atmospheres containing dangerous gases is given in Bureau of Mines Miners' Circular 35.³

TREATING GAS POISONING

The steps in first-aid treatment of poisoning by toxic or noxious gases are:

Always remove the person to fresh air as quickly as possible. Obtain medical aid.

If breathing has stopped, is weak and intermittent, or is present in but occasional gasps, start artificial respiration at once, and continue until normal breathing is resumed or a doctor pronounces the victim dead. When giving artificial respiration, always administer oxygen if available.

Keep the body warm with blankets, hot-water bottles, hot bricks, or other heated objects, taking care that these do not burn the patient.

Keep the patient at rest, lying down, to avoid any strain on the heart. Later give him plenty of time to rest and recuperate.

Inhalations of oxygen, when administered immediately, will greatly reduce the severity of carbon monoxide poisoning, as well as decrease the possibility of serious aftereffects. Give oxygen whether the patient is conscious or unconscious.

All industries in which gas poisoning commonly is present should provide apparatus for efficient administration of oxygen. Such apparatus should be placed at convenient points and employees trained in its use (fig. 9, D).

³ Forbes, J. J., and Grove, G. W., Protection Against Mine Gases: Miners Circ. 35, 1948, 58 pp.

Chapter V. CONTROL OF BLEEDING

CIRCULATORY SYSTEM

The circulatory system (fig. 13) consists of the heart, the arteries, the veins, and the capillaries by which blood is carried to and from all parts of the body.

BLOOD SUPPLY

The blood consists of a fluid called serum or plasma and two types of cells, the red and the white. The function of the blood is to carry nourishment to all the tissues of the body, furnish heat and oxygen, and remove waste matter resulting from tissue activity to such organs of excretion as the lungs, the skin, the kidneys, and the bowels.

One-twelfth to one-fifteenth of the body weight is blood. A person weighing 150 pounds will have 10 to 12 pints of blood in his body. If the blood supply is cut off from tissues, they will die from lack of nourishment and oxygen.

HEART

The heart is a hollow, muscular organ, about the size of a fist, in the lower left section of the chest cavity. By its pump action the blood is kept under pressure and in constant circulation throughout the body. In a healthy person, with the body at rest, the heart contracts about 72 times a minute. The effect of these contractions can be noted by the pulse, which is most easily felt on the thumb side of the inner surface of the wrist.

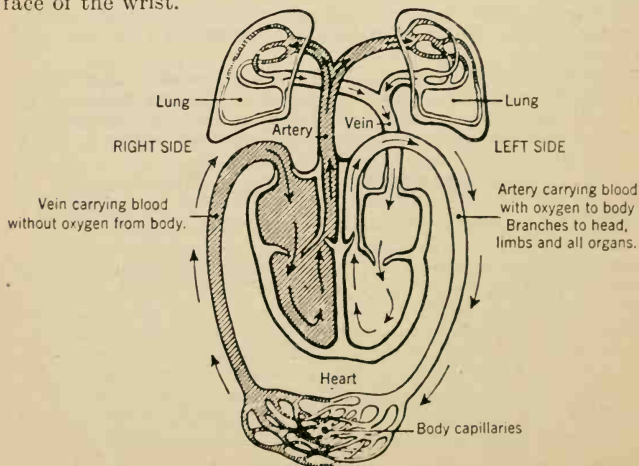


FIGURE 13.—Systemic and Pulmonary Circulation.

BLOOD VESSELS

Pure blood is carried from the heart by a large artery (fig. 14) called the aorta. Branch arteries are given off from this large artery, and the branches in turn give off succeeding branches. These branches divide and subdivide until they become very small and terminate in threadlike vessels known as capillaries, which extend into all the organs and tissues.

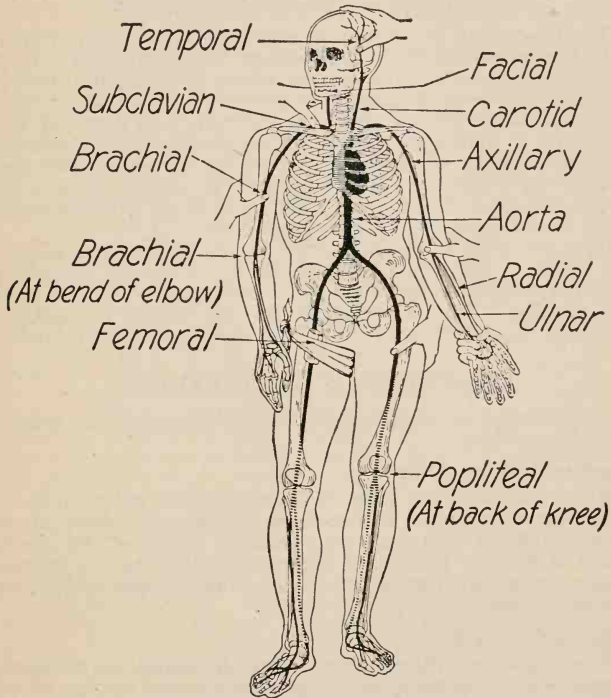


FIGURE 14.—Course of Arteries; Pressure Points.

After the blood has furnished the necessary nourishment and oxygen to the tissues and organs of the body, it takes on waste products, particularly carbon dioxide. The blood returns to the heart by means of a different system of blood vessels known as veins. The veins join the arteries through the capillaries and by a process just the reverse of that given

for the arteries build up the return circulatory system. Very fine veins join, forming larger veins, which in turn join until the very largest veins are formed, returning the blood to the heart. While the blood is returning to the heart it passes through the excretory organs, where certain waste products are removed. When the blood reaches the heart, however, its load of carbon dioxide and some volatile waste matter remains and must be eliminated.

PURIFICATION OF BLOOD BY LUNGS

The heart may be likened to a four-cylinder pump, except that the cylinders do not discharge to a common outlet. When the blood returns to the heart, it must be purified before it can be recirculated, so cylinder 1 draws the impure or venous blood from all parts of the body and passes it into cylinder 2. Cylinder 2 pumps the impure blood to the sponge-like blood vessels of the lungs, where the carbon dioxide and volatile waste products are exchanged for oxygen through the delicate walls of the air cells. Thus the blood is purified and ready to recirculate throughout the body.

Cylinder 3 draws the blood from the lungs back to the heart and passes it into the final cylinder, 4. Through the strong action of cylinder 4 the blood starts out on a new trip through the arteries. The time taken for the blood to make 1 complete circulation of the body averages about $1\frac{1}{4}$ minutes.

HEMORRHAGE OR BLEEDING

Hemorrhage or bleeding is a flow of blood from an artery, vein, or capillary.

Bleeding From an Artery

When blood spurts from a wound and is bright red, an artery has been cut. The blood in the arteries comes direct from the heart and has the pulsating effect of the heart, which is forcing the blood throughout the body. Having been purified and having received a fresh supply of oxygen, it is bright red.

Bleeding From a Vein

When dark-red blood flows from a wound in a steady stream, a vein has been cut. The venous blood is drawn back to the heart through the veins by constant suction; and the blood, having given up its oxygen and received carbon dioxide and waste products in its place, is darker red.

Bleeding From Capillaries

When blood just oozes from a wound capillaries have been cut. There is no cause for alarm, as the amount of blood that can be lost is small; but if blood is spurting from a wound or flowing in a steady stream, it should be checked as soon as

possible, or the patient may lose enough blood to endanger life or cause shock.

The loss of 2 pints of blood by an adult usually is serious, and the loss of 3 pints may be fatal. At certain points in the body fatal hemorrhages may occur in a very short time. The cutting of the two principal blood vessels in the neck, the principal blood vessels in the arm, or the principal blood vessels in the thigh may cause hemorrhage that will prove fatal in 1 to 3 minutes. Rupture of the main trunk blood vessels of the chest and abdomen may cause fatal hemorrhage in less than one-half minute.

When blood is flowing through the body it is fluid, but as soon as a blood vessel is cut nature provides a safeguard by which the blood at the site of the wound thickens or clots and tends to stop the flow. If this did not occur, the slightest scratch would result in loss of all the blood in the body. The blood of some persons will not clot. Such people are commonly called "bleeders"; and they may bleed to death, even from slight injuries, where blood vessels are cut.

A spurting stream of blood will not clot. For that reason arterial bleeding is extremely dangerous. To promote formation of a clot in arterial bleeding, the flow of blood must be slowed to comparative rest. Pinching or compressing the blood vessel cuts down the flow, causes the walls of the blood vessel to adhere, and materially helps in forming a clot.

A sterile compress applied over a bleeding wound causes the blood to mat in the meshes of the gauze of the compress and in most cases of venous bleeding will promote formation of a clot. When a wound in a leg or arm bleeds, a simple constriction, placed below it on the side away from the heart, will retard the venous blood flow and assist formation of clots. Constrictions for controlling venous bleeding should be loosened every 10 minutes, the same as tourniquets.

A sterile compress applied over a wound accompanied by capillary bleeding ordinarily controls the bleeding almost immediately.

Never apply cobwebs, tobacco, or waste in or on a wound to control bleeding. Never put any material other than a sterile dressing in contact with an open wound. The first-aid man is advised to use only pressure, position, and cold in controlling hemorrhage.

In severe bleeding, place the patient in such a position that he will be least affected by the loss of blood. Lay him down with his head lowered (unless there is severe bleeding from the head or a fractured skull), so that the brain will get as much blood as possible. He should be kept at rest, as movements of the body may interfere with clot formation or dislodge a clot formed. Give him plenty of fresh air, and give him water slowly if he is conscious. Keep him warm by covering and heated objects, but give no stimulants while he is bleeding, as they increase the force of the heart action.

METHODS OF CONTROLLING BLEEDING

PRESSURE

Arterial Bleeding

Use digital pressure, and apply a tourniquet over the pressure point between the heart and the wound. Apply a sterile compress and bandage over the wound, and for additional pressure (unless otherwise indicated) tie knots over it.

Venous Bleeding

Constrict the part below the wound away from the heart side, if necessary. Apply a sterile compress and bandage over the wound, and for additional pressure (unless otherwise indicated) tie knots over it.

Capillary Bleeding

Apply a sterile compress and cover with a bandage, tying knots over wound.

POSITION

Arterial and Venous Bleeding

Elevate the wounded part to retard the flow of blood. (Exceptions: Wounds of head where shock is present and there is no fracture of skull, sunstroke, or apoplexy.)

COLD

Arterial and Venous Bleeding

Apply cold applications to the body in the region of the injury (not into the wound), to retard the flow of blood; of particular use in internal bleeding.

ARTERIAL BLEEDING

When an artery has been cut, apply pressure at the nearest available pressure point to control bleeding (figs. 14, 15, 16, and 17). These pressure points are situated throughout the body along trunk arteries. The points where these arteries come close enough to the surface to be reached and are adjacent to bony structures so that pressure can be exerted on the arteries against the bones are the pressure points. There are 22 pressure points on the body—11 on each side. The arteries are tubes comparable to rubber tubing, and if pressure is made upon them against a hard structure the walls may be compressed so that the flow of fluid through them can be retarded or cut off, just as pressure on rubber tubing against a hard surface would lessen or stop the flow of water through such tubing.

Apply pressure to pressure points either by digital (finger or thumb) pressure or by a device used in first aid known as a tourniquet. Where a tourniquet is used, apply digital pressure

first to limit the loss of blood while the tourniquet is being prepared and applied.

Tourniquets cannot be applied to all the pressure points on the body; and in severe bleeding from a wound controlled by a pressure point where a tourniquet cannot be applied, digital pressure must be maintained until the patient is put under a doctor's care and he directs release of the pressure.

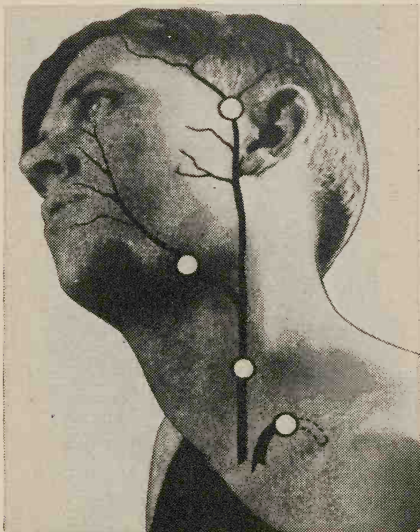


FIGURE 15.—Course of Arteries, and Pressure Points; Head and Neck.

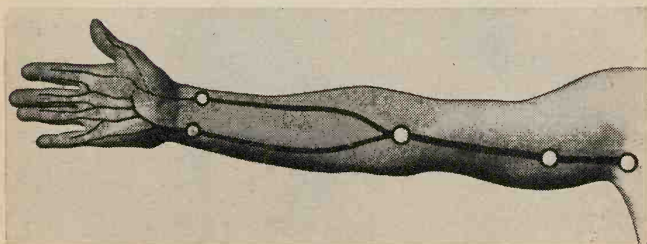


FIGURE 16.—Course of Arteries, and Pressure Points; Upper Extremity.

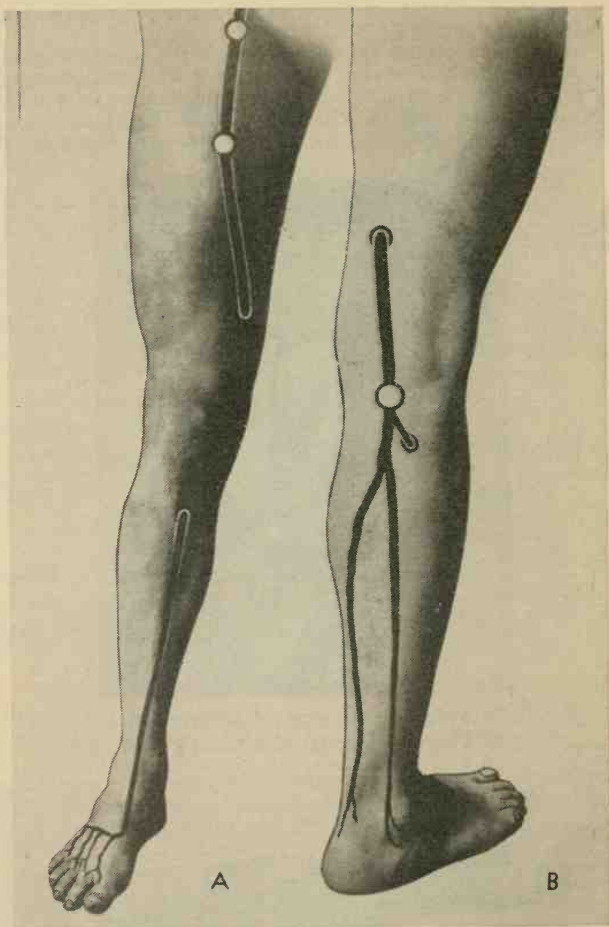


FIGURE 17.—Course of Arteries, and Pressure Points;
Lower Extremity:
A, Front view; B, back view.

Application of Tourniquets

A tourniquet is an appliance used to check severe bleeding from an artery. The standard tourniquet usually is a piece of web belting about 1 inch wide and 36 inches long, with a buckle or snap device catch to hold it tight when applied. The object to apply the pressure on the artery is placed under the belting as it is being tightened. If a regular tourniquet is not at hand, one can be improvised from a strap, belt, suspenders, handkerchief, towel, bandage, necktie, piece of brattice cloth, rubber tubing, or other suitable material. (Never use wire, cord, or anything that will cut into the flesh.)

A tourniquet should be long enough to encircle the limb. A hard pad or object of suitable size should be placed over the artery, so that when the tourniquet is tightened it will press the pad or object against the artery, stopping the flow of blood. The pad may be made of a smooth round stone, a cork, a piece of coal, or some object of similar shape, but it must be well-padded with cloth to keep it from bruising the skin and the walls of the artery.

A cravat bandage may be used to improvise a tourniquet (fig. 18, A), as follows: Obtain a hard object, pad it, and place it over the pressure point. Place the center of a cravat bandage over the padded object to hold it in place by passing bandage around limb and tying it with a single knot. Insert a small pad beneath the knot to prevent injury to the flesh. Then tie a reef (square) knot with the tails of the cravat bandage to form a loop between the single and reef knots. Insert a stick or similar object in the loop, and twist until bleeding stops. Anchor the stick to prevent untwisting after the tourniquet has been applied.

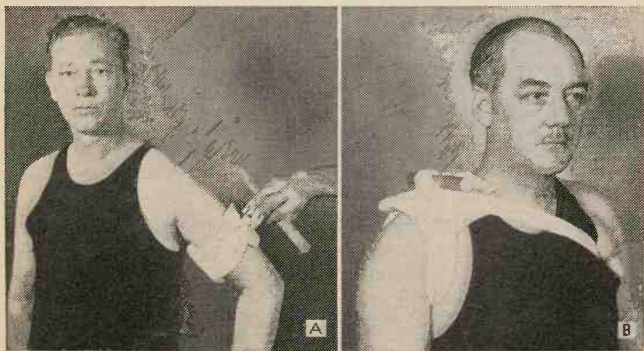


FIGURE 18.—A, Improvised Tourniquet Applied to Arm; B, Tourniquet for Armpit.

Arm or Leg Tourniquets

Place a tourniquet for arterial bleeding over a pressure point between the wound and the heart. An assistant should apply digital pressure over a pressure point while the tourniquet is being prepared. (A tourniquet should not be used if the bleeding can be readily checked otherwise, because it stops circulation of the blood in the limb.) When circulation of the blood is cut off too long death of the tissues of the part may follow; therefore, loosen the tourniquet after it has been in place 10 minutes, but do not remove it. After a tourniquet has been in place tightened for several minutes, the part below the tourniquet gradually turns white and later bluish as the circulation is stopped. If bleeding persists when the tourniquet is loosened at the end of 10 minutes tighten the tourniquet again after a few seconds or until normal color returns to the part below the tourniquet. Never permit a tourniquet to remain tight longer than 10 minutes. The same precaution applies to constrictions made to control venous bleeding.

In all compound fractures of the extremities, apply a tourniquet, but do not tighten it unless necessary. Be sure not to cover the tourniquet with a bandage or bind it with splints so that it cannot be loosened and tightened. If spurting blood should be noted when a patient is being handled or transported, take time to check the bleeding. When a patient with a tourniquet or venous-control constriction is turned over to someone else or to an ambulance or physician, the first-aid man must tell whoever receives the patient if the tourniquet is tight and how long it has been tight.

Tourniquet for Armpit

A deep wound high up on the arm or an amputation at the upper part of the arm requires a tourniquet at the armpit to control bleeding, applied as follows:

Place the center of a narrow cravat bandage in the armpit over a well-padded hard object. Cross ends on shoulder over a pad. Carry ends around back and chest to opposite armpit, and tie over a pad. To tighten, insert a small stick or similar object under cross of bandage on shoulder, and twist until bleeding is controlled, then secure or anchor stick to prevent untwisting (fig. 18, *B*). The tourniquet may be loosened by untwisting the stick.

New Technique in the Application of Tourniquets

A new procedure in the application of a tourniquet has been used with considerable success by the military forces and has been adopted by the American Red Cross and Federal Civil Defense Administration. Knowledge of this procedure will be of value in treating victims of mass casualties.

In this new procedure, the tourniquet is placed just above the wound and should be applied tight enough to stop bleeding.

Once the tourniquet is applied it should be released only by a physician, no matter how long it has been in place. A notation should be made and attached to the victim giving the location of tourniquet and time of application.

This procedure recognizes the fact that some limbs may be lost because gangrene may develop if tourniquets are left in place for long periods, but it is preferable to accept the risk of gangrene in an already badly damaged extremity than to jeopardize life from hemorrhage by removal of the tourniquet. Experience by the military forces has shown that a tourniquet may be undisturbed for 3 or 4 hours with relative little risk of gangrene.

A tourniquet should be used only for severe life-threatening hemorrhage, which cannot be controlled by other means. Actually, the use of a tourniquet is seldom required. Crushing wounds or large lacerations, where large arteries are severed or a body part is partly or completely severed, are the only instances where application of a tourniquet may be justified.

INTERNAL BLEEDING

Internal hemorrhage may result from a deep wound that cuts large blood vessels of the chest or abdominal cavities or one or more of the internal organs or from rupture of internal blood vessels due to deep bruises. In internal hemorrhage the bleeding may not be seen, but the condition may be determined by the symptoms presented by the patient.

The symptoms of internal bleeding are faintness, cold skin, pale face, dilated pupils, thirst, feeble and irregular breathing, sighing, clouded vision, weak and rapid pulse, dizziness, and later loss of consciousness. The severity of the symptoms depends on the amount and rapidity with which blood is lost.

Lay the patient down, with the head lower than the body, except for fracture of skull and apoplexy, when the head is raised. Apply ice or cold cloths to the body at the point from which you think the bleeding comes. Do not give stimulants unless absolutely necessary. You may give ice water or cold water slowly if patient is conscious. Keep the patient covered, and obtain medical aid as quickly as possible.

Chapter VI. SHOCK AND FAINTING

PHYSICAL SHOCK

THE NERVOUS SYSTEM

The nervous system plays a very important part in physical shock, which in some degree follows most injuries. Knowledge of the nervous system is helpful in understanding the causes, recognition, and treatment of shock.

The various parts of the body and the organs controlling the body functions are kept in touch with each other by the nervous system. The latter really consists of two separate but interconnected and coordinated systems, the cerebrospinal and the sympathetic.

The cerebrospinal system consists of the brain and the spinal cord. The brain is a collection of nerve centers, each a central station for some part of the body, much like a central telephone station, with trunk lines or nerves connecting the parts of the body with their particular centers. Leaving the brain, these trunk nerves are bundled into the spinal cord, which passes down through the opening in the center of the backbone or spinal column, giving off branches to all parts and organs of the body.

The nerves entering and leaving the spinal cord are mainly of two types—sensory nerves, which enter the cord, conveying impressions of sensations, such as heat, cold, touch, and pain from different parts of the body to the brain; and motor nerves, which leave the spinal cord, conveying impulses from the brain to the muscles causing movement.

The sympathetic system is a series of nerve centers in the chest and abdominal cavity along the spinal column. Each of these nerve centers, although interconnected with the cerebrospinal system, presides over and controls vital organs and vital functions. This system is not under control of the will, but through it involuntary muscles are stimulated to act alike during periods when we are awake and when we are asleep. Thus our hearts beat, we breathe, our blood pressure is maintained, we digest our food, and our excretory organs function without any effort on our part.

CAUSES OF SHOCK

Physical shock is a state of collapse or prostration that interferes with normal action of the heart, respiration, and circulation. This condition is probably due to derangement or lack of proper balance within the sympathetic nervous system that controls these vital functions.

The state of shock may develop rapidly or may be delayed and manifest itself hours later. Shock occurs to some degree after every injury. It may be so slight as not to be noticed. It is a serious condition in many injuries and frequently results in death where the injuries received ordinarily would not prove fatal.

Causes of shock are as follows:

- Severe or extensive injuries.
- Severe pain.
- Loss of blood.
- Surgical operations.
- Severe burns.
- Accidents due to electricity or gas.
- Certain illnesses.
- Poisons taken internally.
- Exposure to extremes of heat or cold.
- Seeing own injuries or injuries of others.
- Fright.
- Anger.
- Joy.

SYMPTOMS

Face pale, with anxious or dull expression.

Eyelids droop if open; eyes are dull and pupils large.

Patient may be partly or totally unconscious.

Skin is cold and covered with a clammy sweat, particularly the hands and forehead.

Patient feels cold and may have a chill; temperature subnormal.

Pulse is weak and rapid, if it can be felt.

Breathing is shallow and may be irregular.

Patient is stupid and takes little interest in things about him.

If internal bleeding is present, patient will be restless; if conscious, he complains of clouded vision, dizziness, and thirst.

He may answer questions slowly or apparently fail to understand.

Nausea and vomiting often occur.

Some of the things known to take place within the body in cases of shock bear directly on the symptoms presented. The most important thing that occurs in shock is a decided drop in the blood pressure, believed to be caused by the loss of control by the sympathetic nervous system over certain small blood vessels. Meanwhile the capillaries and blood vessels in the interior of the body, particularly in the abdominal cavity, dilate and become engorged with blood. This removal of blood from general circulation causes the blood pressure to fall and decreases the volume of blood passing through the heart and lungs.

As a large amount of blood goes to fill the dilated vessels within the body, the circulation near the surface is decreased, causing the skin to become pale, cold, and clammy. Like-

wise, many organs of the body suffer from decrease in the normal blood supply; in the eyes, for example, this causes drooping lids and dullness.

With fall of the blood pressure and the unusual amount of blood drawn from the circulation to fill the dilated and engorged blood vessels within the body, less blood returns to the heart for recirculation. In an effort to overcome the decreased volume and yet send blood to all parts of the body, the heart speeds its action, pumping faster but with a much lowered quantity, and the pulse is rapid and weak.

Likewise, the decreased amount of blood passing through the lungs requires less air to oxygenate the smaller amount of blood; hence, the respiration becomes shallow and feeble.

The brain, as well as other organs, suffers from decreased blood supply and does not function normally; the patient's powers of reasoning, thinking, and expression are dulled.

Nausea and vomiting are believed to be caused by congestion and engorgement of the blood vessels within the abdominal cavity.

TREATMENT

Shock is a dangerous condition that should be given prompt attention; medical aid should be obtained as soon as possible.

Place the patient in a comfortable position, lying down. Be sure that his head is on a level with the body if he is on the ground (exceptions, *see* Fracture of Skull, p. 88; unchecked severe hemorrhage from the head; Sunstroke, p. 130; and Apoplexy, p. 133). If there is a moderate slope of the ground where the patient is lying, place his head downgrade. Where the patient is on a stretcher or body splint, elevate the feet end of the stretcher or body splint at least 6 inches.

Remove all foreign bodies from the patient's mouth, such as false teeth, tobacco, gum, and like material, and cleanse the mouth of mucus or phlegm. See that tongue is forward and not back over the windpipe.

Loosen tight clothing from neck, chest, and waist.

If the patient is nauseated and vomits, turn his head to one side so that vomited matter will flow from the mouth. Keep his mouth and face wiped clean.

Permit the patient to have plenty of fresh air.

Wrap the patient in blankets or other covering, clothing, brattice cloth, or other available material as early as possible. Cover the entire body except the head, but take care not to contaminate injuries. Place blankets and other covering material under the patient as well as over him to prevent loss of heat to the ground or floor.

Keep the patient only warm enough to be comfortable. If conditions, such as cold weather, make use of external heat desirable, apply heated objects, such as hot-water bottles, heated bricks, or stones, along the body, between the legs, and in the armpits. Always wrap and test heated

objects before applying them, as a person in shock frequently cannot make known that heated objects are hot enough to burn him.

Give the patient stimulants by mouth if he is conscious or by inhalation if he is unconscious, unless there is unchecked severe bleeding, internal bleeding, fracture of the skull, sunstroke, or apoplexy. In first aid the stimulants recommended for use by mouth if the patient is conscious are aromatic spirits of ammonia (1 teaspoon in one-half glass of water), hot coffee, hot tea, or hot water. Give hot coffee, tea, or water, as warm as the patient can drink it, in small quantities, not to exceed 1 cup in one-half hour. Administer aromatic spirits of ammonia in water to a conscious person by sips, not to exceed one-half glass during a 20-minute period. Too much liquid may cause the patient to vomit. If patient is unconscious, give him nothing by mouth, as he may not be able to swallow and the substance may pass into the windpipe and choke him. Administer aromatic spirits of ammonia to an unconscious person in shock by pouring it on a piece of gauze or cloth and passing it back and forth under his nose for 30 to 40 seconds at about 5-minute intervals. Test aromatic spirits of ammonia before use, either by mouth or inhalation. Mistakes have been made where household ammonia has been used instead of aromatic spirits of ammonia.

Inhalation of oxygen, if available, often is helpful in shock.

The most important thing in treating shock is to restore body warmth by adequate covering over and under the body, heated objects within the covering, and warm drinks, if the patient is conscious. There is a decided relationship between body temperature and blood pressure, heart action, and respiration. As body temperature returns to normal, the sympathetic nervous system regains its control over the vital functions, restoring circulation and improving heart action by decreasing the heart speed and increasing the heart volume; respiration becomes deeper and more regular.

Next to reestablishing normal body temperature by warmth, the position of the patient plays an important part in caring for shock. If the patient is lying down and his head is on a level with or lower than the feet, the flow of blood to and from the overworked heart is greatly aided. By taking advantage of gravity, the blood in the dilated and engorged blood vessels in the abdominal cavity tends to drain back to the heart, not only increasing the amount of blood reaching the heart but relieving part of the strain on the heart due to its attempt to supply all parts of the body with the required amount of blood. Never permit a patient in a state of shock to sit up, as the additional strain on the circulation and heart will greatly increase the state of shock.

Stimulants used in first aid play a part in combating shock, but their effects are more or less transient. They are more effective in mild cases of shock than in profound shock.

Hot coffee and hot tea, both of which contain caffeine, have a more prolonged effect than aromatic spirits of ammonia but require a longer time for absorption. Aromatic spirits of ammonia is a rapid but transient stimulant.

As long as evidence of shock is present, continue shock treatment. Patients in a state of shock tend to relapse, even after their condition has greatly improved. Watch for a relapse, and combat it by renewed shock treatment. After the patient has recovered from shock of even short duration, keep him lying down and quiet, so that as little strain as possible is placed on his circulation and heart action.

Where hemorrhage accompanies shock, special care is required to determine the seriousness of the bleeding. The lowered blood pressure and feeble heart action present in shock keep a wound from bleeding freely; but, as the effects of shock wear off, normal blood pressure and heart action return, and if the bleeding has not been checked properly it may become serious. Recheck sources of hemorrhage in shock cases at frequent intervals.

FAINTING

CAUSES

Fainting is temporary loss of consciousness caused by an inadequate supply of blood to the brain and is a mild form of physical shock. Fainting may be caused by an injury, the sight of blood, exhaustion, weakness, heat, lack of air, and the emotions, such as fright or joy. Some persons faint much more readily than others.

SYMPTOMS

The patient feels weak and becomes dizzy, black spots appear before his eyes, his face becomes pale and lips blue, and his forehead is covered with perspiration. He then sinks back in his seat or falls to the ground unconscious. The pulse is rapid and weak, and the breathing is shallow. The above symptoms usually occur in a few seconds.

Fainting is one of the more frequent occurrences that require first aid. A patient lying down seldom faints; therefore, in first aid it is always best to have the patient in the lying position. It is much easier to make an examination and to dress most injuries, and in many instances it will ward off fainting. An injured person being examined in a sitting or standing position may faint suddenly and fall, either aggravating his original injuries or causing additional ones. Where early symptoms of fainting are noted, unconsciousness may be prevented by lowering the patient's head immediately. If a person is sitting, bend the body at the waist, and bring the head down between the knees. Better still, if space is available, lay the person down with the head low.

TREATMENT

See that the patient is lying down with head low.

Cleanse his mouth.

Loosen tight clothing at neck, chest, and waist.

Allow the patient to have plenty of fresh air.

Give aromatic spirits of ammonia by inhalation.

If the body surface feels cold, cover to retain heat.

When consciousness returns, give aromatic spirits of ammonia, 1 teaspoon in one-half glass of water, in sips.

When a patient recovers consciousness after fainting, do not permit him to rise immediately, but keep him lying down and quiet at least one-half hour.

If unconsciousness is prolonged, apply the full treatment for physical shock, and call a physician.

Chapter VII. WOUNDS AND DRESSINGS

OPEN WOUNDS

An open wound is any break in the skin. When the skin is unbroken, it affords protection from most infections, bacteria, or germs. However, when the skin is broken, no matter how slight the break, germs may enter, and an infection may develop. Any wound where the skin is broken should receive prompt medical attention, and only sterile objects should be in contact with any open wounds. If germ life has been carried into an open wound by the object causing the break in the skin, nature attempts to wash out the germs by the flow of blood; but, as will be shown later, some types of wounds do not bleed freely.

Statistics show that about 1 open wound in every 20 shows evidence of infection, and where open wounds do not receive early first aid or medical care the rate of infection is nearly doubled.

A break in the skin may range from a pin puncture or scratch to an extensive cut, tear, or mash. An open wound may be only the surface evidence of a more serious injury to deeper structures, such as fractures, particularly, in head injuries involving fracture of the skull. In first aid, open wounds are divided into four classifications.

ABRASIONS

Abrasions are wounds caused by rubbing or scraping. These wounds are seldom deep, but a portion of the skin has been removed, leaving a raw, bleeding surface. The bleeding in most abrasions is capillary only. Abrasions are easily infected owing to the amount of underskin surface exposed.

INCISED WOUNDS

Wounds produced by a sharp cutting edge, such as a knife, a piece of glass or metal, or a sharp edge of coal, rock, or slate, are incised wounds. The edges of such wounds are smoothly divided without bruising or tearing. Incised wounds bleed freely and are not so liable to infection as wounds of other types.

LACERATED WOUNDS

Lacerated wounds are those with ragged edges, and have been torn or mashed by blunt instruments, machinery, or rough surfaces. These wounds, in which the blood vessels are torn or mashed, do not bleed as freely as incised wounds.

However, the ragged and torn tissues, with the foreign matter that is often forced or ground into the wound, make the danger of infection greater than in incised wounds.

PUNCTURED WOUNDS

Punctured wounds are produced by pointed instruments, such as needles, splinters, nails, or pieces of wire. Such wounds usually are small but may be very deep. Most of the articles causing punctured wounds are soiled, and matter causing infection often is introduced deep in the tissues. The small openings in punctured wounds and the few blood vessels cut prevent free bleeding. The danger of infection in punctured wounds is far greater than in any other type of wound.

GENERAL DIRECTIONS FOR CARE OF OPEN WOUNDS

The chief duties of a first-aid man in caring for an open wound are to check hemorrhage and to prevent germs from getting into it. If germs do not enter there will be no infection, and the parts will heal quickly.

Rip or cut the clothing so that the injury may be seen. If loose foreign particles are in or around the wound, wipe them away with sterile gauze. Always wipe away from the wound, not toward it. Do not attempt to remove a foreign object embedded in the wound. Leave that to the doctor, as it may aid him in determining the extent of the injury and the involvement of deeper parts.

Leave the work of cleansing the wound to the doctor. The Bureau of Mines suggests that antiseptics be used by first-aid men only when the plant or mine physician supplies the drugs, gives instructions how to use them, and assumes responsibility for their use.

Do not touch the wound with your hand, clothing, or anything that is not sterile, and do not pour water or any drug into or on it. Place a sterile bandage compress or sterile gauze over the wound, and tie it in place. Protect all bandage compresses or sterile gauze dressings by an outer dressing made from a cravat or triangular bandage, except dressings for wounds of the eye, nose, chin, finger, and toe, or compound fractures of the hand and foot when splints are applied.

Take care to make all sterile dressings wide enough to cover completely the wound and an area on each side of it. If the cravat bandage is already folded, open it enough to cover the entire sterile dressing.

Unless otherwise specified, tie the knots of the sterile bandage compress and cover bandage over the wound on top of the pad of the compress to assist in checking the bleeding.

Where there is severe bleeding from an artery, always check

it by digital pressure and then by the use of a tourniquet when necessary if a tourniquet pressure point is available. **Never** forget the danger of leaving a tourniquet tight longer than 10 minutes.

Usually considerable shock follows wounds, especially if much blood is lost. Treat shock promptly.

BANDAGING

Bandage wounds firmly, but never tightly. A tight bandage may interfere with the blood supply and thereby cause serious results. In bandaging the arms or the legs, leave the tips of the fingers or toes uncovered where possible, so that they may be seen. This permits easy examination to determine if bandages are too tight. Always place the part to be bandaged in the position in which it is to be left. Remember that swelling frequently follows an injury and that a tight bandage may cause serious interference with circulation to the part. On the other hand, do not apply a bandage too loosely, as it may slip off and expose the wound. If the patient complains that the bandage is too tight, loosen it, and make it comfortable but snug. Never apply a wet bandage, except where picric-acid gauze and cover bandage are used in treating burns. Always apply these dressings loosely.



FIGURE 19.—Dressing for Extensive Wounds of Scalp:
A, Compress applied; B, dressing complete.

DRESSINGS FOR WOUNDS AND BLEEDING

EXTENSIVE WOUNDS AND BLEEDING OF SCALP

A wound or wounds involving a large area of the scalp may be dressed by covering the injury with a piece of sterile gauze or a large sterile bandage compress. When a bandage compress is used, carry 1 end under the chin and the other end over the top of the head, cross ends at temple, carry 1 end around forehead, pass the other end around the back of the head, and tie at opposite temple. Then apply a triangular bandage over the head, having the base fit snugly across the forehead just above the eyebrows and the apex of the bandage at the back of the neck. Bring the two ends of the bandage around the head just above the ears, and cross under the bony prominence on the back of the head, then return the ends to the middle of the forehead and tie just above the eyebrows. Fold up the apex and tuck in snugly over the crossed ends at the back of the head. When sterile gauze is used, take care to keep it in place while the cover bandage is being applied (fig. 19).

WOUND AND BLEEDING OF SCALP, TEMPLE, EAR, OR FACE

Apply the pad of a sterile bandage compress over the wound; carry 1 end under the chin and the other end over the top of the head; cross the ends on the opposite side; carry 1 end around the front and the other end around the back of the head; and tie over the compress. If the wound is on the back of the ear, place the compress between the wound and the head. Cover the compress with a cravat bandage applied in the same way (fig. 20, *A* and *B*). If the wound is on the cheek or the front of the face, cross the bandage compress and cravat bandage behind the ear, on the side opposite the injury, bring it around the forehead and back of the head, and tie (fig. 20, *C*).

WOUND AND BLEEDING OF FOREHEAD OR BACK OF HEAD

For a wound of the forehead, apply the pad of a sterile bandage compress over the injury, and hold it in place by passing the ends of the bandage compress around the head above the ears, crossing them behind under the bony prominence, bringing them forward, and tying them in front over the wound. Then apply the center of a cravat bandage over the pad, take the ends to the back of the head, cross them, bring to the front, and tie (fig. 21, *A*). This dressing also may be used for a wound on the back of the head, the bandage compress being applied over the wound and tied, then covered with a cravat bandage, the center being placed over the compress, and the ends taken around the head and tied over the compress pad.



FIGURE 20.—Dressing for Wounds of Scalp, Temple, Ear, or Face:

A, Dressing for wound of scalp, temple, or ear; *B*, bandage over uninjured temple; *C*, dressing for wound of face.

INJURIES OF EYE

For all injuries to the eye use a sterile bandage compress, as follows: Place the center of a bandage compress over the injured eye, carry the end on the injured side below the ear to the back of the head, and carry the other end above the ear on the opposite side; tie somewhat toward the injured side below the bony prominence on the back of the head. Bring both ends over the top of the head, passing the longer end under the dressing at the temple on the uninjured side. Then slide it in front of the uninjured eye, and pull it tightly enough to raise the dressing above the uninjured eye, and tie to the other end on top of the head (fig. 21, *B*).



FIGURE 21.—A, Dressing for Wound of Forehead; B, Dressing for Injury of Eye; C, Dressing for Wound or Fracture of Nose; D, Dressing for Wound of Chin.

WOUND AND BLEEDING OF NOSE

For a wound of the nose, split the tails of a sterile bandage compress. Apply the pad of the compress to the wound; pass the top tails one to each side of the head below the ears and tie at back of neck; pass the bottom tails, one to each side of the head above the ears, and tie at the back of the head (fig. 21, C).

Nose bleeding, often considered unimportant, may be serious enough to endanger life. Keep the affected person in a sitting position, with the head thrown slightly back. Applying firm pressure to both sides of the nose by grasping it between the first finger and thumb will control the hemorrhage in some cases. Have the patient avoid blowing his nose for several hours. If bleeding persists, procure medical attention.

WOUND AND BLEEDING OF CHIN

Split the tails of a sterile bandage compress, and apply the pad to the wound; pass the top tails, 1 to each side of the neck below the ears, and tie at back of neck; pass the bottom tails, 1 to each side of head in front of ears, and tie at top of the head (fig. 21, D).

WOUND AND BLEEDING OF NECK OR THROAT

Apply the pad of a sterile bandage compress to the wound, pass the ends around the neck, and tie over the wound. Then place the center of a cravat bandage over the compress, take the ends around the neck, cross them, bring them around the neck again, and tie loosely. If bleeding of the neck or throat is severe, check it by pressure of the fingers, wrapped with sterile gauze if available and placed directly in the wound.

WOUND AND BLEEDING OF SHOULDER

For wound and bleeding of the shoulder, apply the pad of a sterile bandage compress over the wound, bring the ends under the armpit, cross, carry to the top of compress, cross, carry 1 end across the chest and 1 end across the back, and tie in the opposite armpit. Cover with a triangular bandage as follows: Place the apex high up on shoulder, place the base along which a hem has been folded below the shoulder on the upper part of the arm, and carry the ends around the arm and tie them on the outside. To hold the bandage in position, place the center of a cravat bandage under the opposite armpit, carry the ends to the shoulder over the apex, tie a single knot (fig. 22, A), and then fold the apex over and complete the knot. Place the forearm in a sling made of an open triangular bandage, as shown in figure 6, A.



FIGURE 22.—A, Dressing for Wound of Shoulder; B, Dressing for Wound of Armpit.

WOUND AND BLEEDING OF ARMPIT

Apply the pad of a sterile bandage compress over the wound, crossing the ends over the shoulder; carry one end across the chest and the other end across the back, and tie under the opposite arm. If severe hemorrhage is present, place some hard material, about the size of an egg, such as a piece of coal, stone, or wood, covered with cloth, over the pad of the compress, and push it well up into the armpit, holding it in place by a cravat bandage. Place the center of the cravat bandage over the hard material, bringing the ends over the shoulder and crossing them. Then pass the ends around the chest and back, and tie them under the opposite armpit. Then bring the arm down and secure it firmly to the chest wall by a cravat bandage passed around the arm and chest and tied securely on the opposite side. Place the forearm in a sling made of an open triangular bandage (fig. 22, B).

ARM TORN FROM BODY

When an arm has been torn from the body at the socket, there is profuse bleeding from the larger blood vessels that are severed; therefore treatment should be prompt. Cover your hand thoroughly with sterile gauze, if it is available, pass the hand right up into the wound, and pinch the blood vessels. An assistant should make digital pressure over the subclavian

artery to assist controlling hemorrhage temporarily. Then pack the wound with sterile gauze and bandage firmly. However, if there is no gauze at hand, do not wait, but place your fingers in the wound and pinch the blood vessels. While doing this, have an assistant obtain and prepare gauze; when it is ready, let go of the vessels, push the sterile gauze firmly into the wound, and bandage. Apply the pad of a bandage compress over the seat of the injury, passing the ends around the chest and back and tying securely under the opposite arm. Then place the center of a cravat bandage over the pad, carry the ends across the chest and back, and tie under the opposite armpit.

DRESSING FOR AMPUTATED ARM

Control hemorrhage by digital pressure until a tourniquet is applied. Dress the end of the stump with sterile gauze or gauze procured from a sterile bandage compress, as described on page 18. Hold the dressing in place with a triangular bandage, as follows: Make a fold along the base of a triangular bandage; place the stump in the center of the triangular bandage with the base against inside of arm, and carry the apex over the stump and up on the outside of the arm; cross the ends on the outside of the arm, bring around the arm and cross them under the arm, and bring the ends to the front of arm and tie; then fold the apex over the knot, and tuck it under. Apply similar dressing to a stump of the forearm, wrist, or hand.

WOUND AND BLEEDING OF ARM, FOREARM, AND WRIST

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the arm, and tie them over the pad. Then place the center of a cravat bandage over the pad; pass the ends around the arm, cross them, continue around the arm, and tie over the pad (fig. 23, *A* and *B*). Control arterial bleeding of the arm by temporary pressure of the fingers or thumb over the artery at a pressure point above the wound, and apply a tourniquet at the nearest practicable pressure point. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF ELBOW

Apply the pad of a sterile bandage compress over the wound, pass the ends around the elbow, cross them, carry them around the arm just above the elbow, cross them, carry them around the forearm just below the elbow, cross them, and tie on the outer side of the forearm. Cover with a cravat bandage as follows: Place the center over the point of the elbow, pass the ends around and cross them at the bend of the elbow, cross

them again above the point of the elbow, carry them around the arm, cross again at the bend of elbow, carry around forearm, and tie at outer side below point of elbow (fig. 23, *C*). Hold the elbow in a slightly bent position while the dressing is being placed to avoid applying the bandage too tightly. Control arterial bleeding of the elbow by temporary pressure, then apply a tourniquet at arm pressure point. Place forearm and hand in a triangular bandage sling.

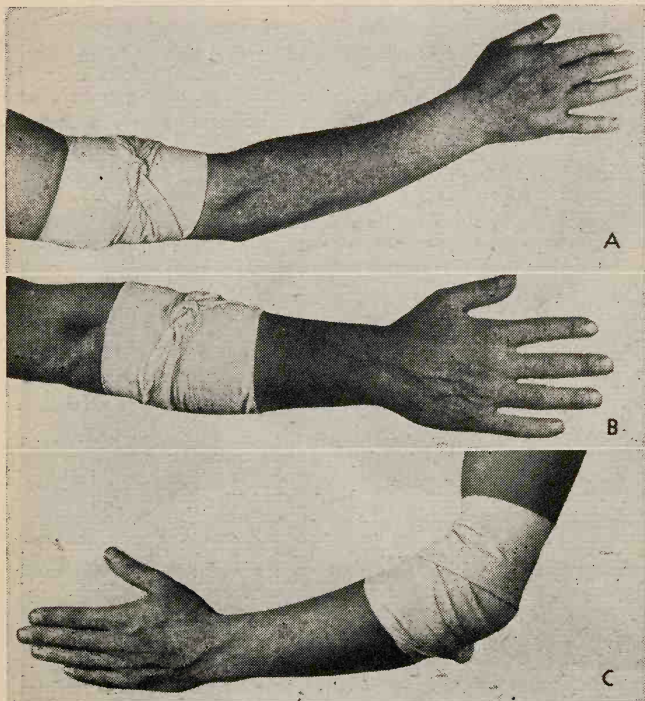


FIGURE 23.—Dressings for Wounds of Arm:
A, Arm; B, forearm; C, elbow.

WOUND AND BLEEDING OF PALM OF HAND

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the hand and wrist, and tie them over the pad. Place the center of a cravat bandage over the pad, cross the ends at the back of

the hand, bring one end around the little-finger side of the hand, bring the other end between the thumb and forefinger, cross the ends well back on the palm, continue around the wrist, crossing at the back of wrist, cross again at inside of wrist, and tie at back of wrist (fig. 24, A).

Control arterial bleeding of the palm of the hand by digital pressure at a convenient pressure point. Then apply a tourniquet at arm pressure point. Place the forearm and hand in a triangular bandage sling.



FIGURE 24.—A, Dressing for Wound of Palm of Hand; B, Dressing for Wound of Back of Hand.

WOUND AND BLEEDING OF BACK OF HAND

Apply the pad of a sterile bandage compress over the wound, pass the ends several times around the hand and

wrist, and tie over the pad. Place the center of a cravat bandage over the pad, cross the ends at the palm of the hand, bring one end around the little-finger side of the hand, bring the other end between the thumb and forefinger, cross the ends on the back of the hand and continue around the wrist, cross at inside of wrist, and tie at the back of the wrist (fig. 24, B).

Control arterial bleeding, if present, as described in dressing for wound and bleeding of palm of hand.

Place the forearm and hand in a triangular bandage sling.

EXTENSIVE WOUNDS AND BLEEDING OF HAND

Use this dressing for wounds involving the hand and fingers or multiple wounds of the fingers.

Apply sterile gauze or a large sterile bandage compress over wound. When there are multiple wounds of fingers, separate them with pads of sterile gauze. If a bandage compress is used, pass the ends several times around the hand and wrist, and tie them over the pad. Cover with a triangular bandage, as follows: Place the base on the inner side of the wrist, bringing the apex down over the palm of the hand and returning it around the tips of the fingers and over the back of the hand to a point above the wrist. Cross the ends, one on either side of the wrist, bring them to the forearm just above the wrist, and tie them on the back of the wrist. Bring the apex down over the knot, and tuck it under (fig. 25). This type of cover bandage can also be applied for an injury to the back of the hand.

Control arterial bleeding for extensive wounds of the hand as for arterial bleeding of the palm of the hand. Place the forearm and hand in a triangular bandage sling.

WOUND AND BLEEDING OF FINGER

Apply the pad of a small sterile bandage compress over the wound, pass the ends several times around the finger, and tie them over the pad, or use a small adhesive compress for the finger. Remove the cover from the adhesive by pulling from the center. Place the sterilized pad over the wound, pass an end of the adhesive around the finger, and press it down smooth; then bring the other end around the other side of the finger, drawing the compress so that it is snug, and press it down. If the injuries are slight, apply a small bandage compress or adhesive compress to each finger as directed above. If the injuries are extensive or severe, dress as for extensive wounds of the hand (fig. 25), and apply a triangular bandage sling.

Control arterial bleeding as described for wounds and bleeding of hand.

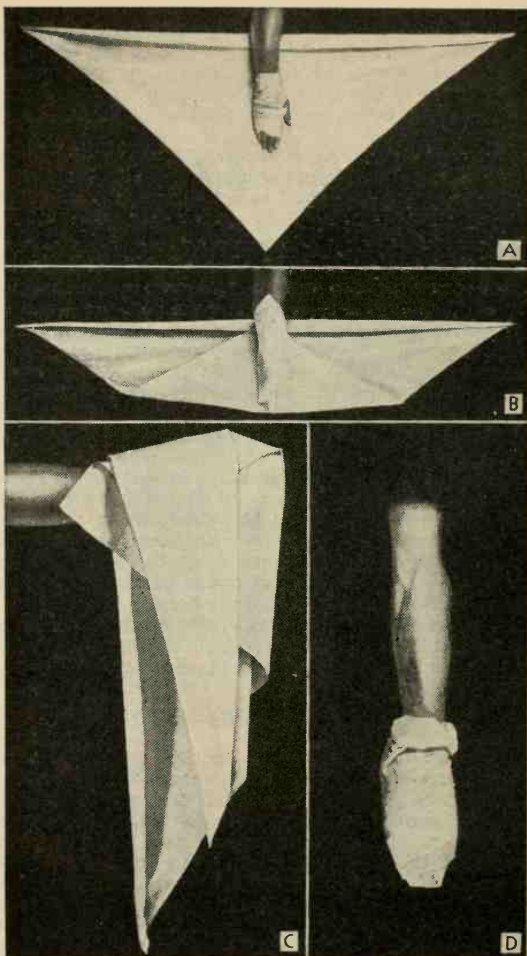


FIGURE 25.—Dressing for Extensive Wounds of Hand:
A, Compress applied, hand resting on triangular bandage;
B, apex carried over ends of fingers and back of hand to
 wrist; *C*, one end folded over; *D*, dressing complete.

WOUND OF END OF FINGER

Apply the pad of a small sterile bandage compress over the wound so that the tails hang down on the front and back of the finger. Hold the tails securely in place about the middle of the second bone of the finger. Make 1 circular turn with 1 of the tails above that point to anchor the bandage. Carry this tail to the end of the finger, and by a circular turn bind in the edges of the compress; then carry the tail by special turns to the starting point. Omitting the first circular turning, apply the other tail in a similar manner, with spiral turns in the opposite direction, and tie the ends on the back of the finger.

When the ends of two or more fingers are injured, apply a small sterile bandage compress to each finger as directed above, then cover as for extensive wounds of the hand (fig. 25), and apply a triangular bandage sling.

WOUND AND BLEEDING OF BACK BETWEEN SHOULDERS

Place the pad of the compress over the wound so that the ends are diagonally across the back, carry one end over the shoulder and under the armpit, carry the other end under the opposite armpit over the shoulder, and tie the ends over the compress. Cover the compress and shoulders with a triangular bandage, as follows: Place the center of the base at the back of the neck, allowing the apex to drop down between the shoulders, carry the ends over the shoulders and under the armpits and around the back, and tie a knot over the apex; then turn the apex up, and tuck it over the knot (fig. 26, *A* and *B*).



FIGURE 26.—Dressing for Wound of Back Between Shoulders:

A, Compress applied; *B*, completed.

WOUND AND BLEEDING OF CHEST BETWEEN SHOULDERS

Place the pad of the compress over the wound so that the ends are diagonally across the chest, carry one end over the shoulder and armpit, carry the other end under the opposite armpit over the shoulder, and tie the ends over the compress. Cover the compress and chest with a triangular bandage, as follows: Place the center of the base at the lower part of the neck, allowing the apex to drop down over the abdomen, carry the ends over the shoulders around under the armpits to the center of the chest, and tie with the apex below the knot; then turn up the apex, and tuck it over the knot (fig. 27).



FIGURE 27.—Dressing for Wound of Chest Between Shoulders.

WOUND AND BLEEDING OF BACK, CHEST, ABDOMEN, OR SIDE

Apply the pad of a sterile bandage compress over the wound, take the ends around the body (one end across the back and the other across the chest), and tie on the side. Cover with a cravat bandage by placing the center of the bandage on the side nearest to the injury, taking the ends across the back and chest and tying on the opposite side.

WOUND AND BLEEDING OF LOWER PART OF ABDOMEN, LOWER PART OF BACK, OR BUTTOCKS

For wound and bleeding of the lower part of the abdomen, the lower part of the back, or the buttocks apply the pad of a sterile bandage compress over the wound, holding it in place by passing the ends around the body and tying them. Cover the compress with two triangular bandages. Tie the apexes of two triangular bandages together. Place the apexes in the crotch, bring the base of one bandage up on the abdomen, pass ends around to the back, and tie. Bring the base of the other bandage up on the back, pass the ends around to the abdomen, and tie (fig. 28, A).

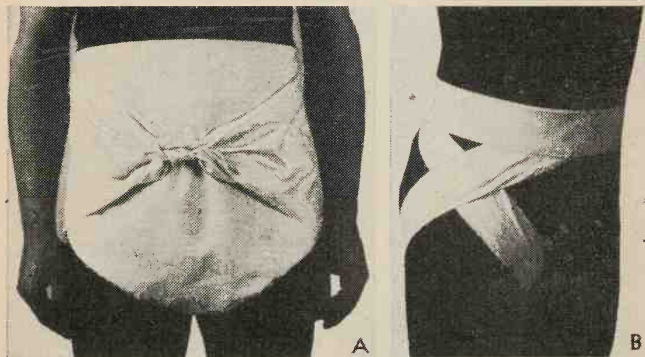


FIGURE 28.—A, Dressing for Wounds of Lower Part of Abdomen, Lower Part of Back, or Buttocks, Using Spliced Triangular Bandages; B, Dressing for Wound of Groin.

WOUND AND BLEEDING OF GROIN

Apply the pad of a sterile bandage compress over the wound, carry the ends to the hip, cross them, carry across to the opposite side of the body, and tie. To cover the compress, use two cravat bandages tied together to make them long enough. Place the center of one of the cravat bandages over the pad, and follow the compress in such a manner as to cover it entirely. Continuing with the cravat bandages, pass them around the entire body the second time, and tie (fig. 28, B).

WOUND AND BLEEDING OF CROTCH

Apply the pad of a sterile bandage compress or sterile gauze to the wound. When applying a sterile bandage compress, place the pad over the wound, bring one end up between the buttocks and around the body over the hip to the center of the abdomen, and bring the other end up to the center of the abdomen, passing over the top of the first end; then fold the short end back in the direction from which it came, pass the long end around the opposite side of the body, and tie at the side of the hip. Pass a cravat bandage around the body, and tie in front. Place the center of a cravat bandage under the knot of the first bandage (fig. 27, *A*). Pass the 2 ends of the cravat bandage between the thighs, bring 1 end around each hip, and tie to the ends of the cravat bandage tied around the body (fig. 29, *B*).

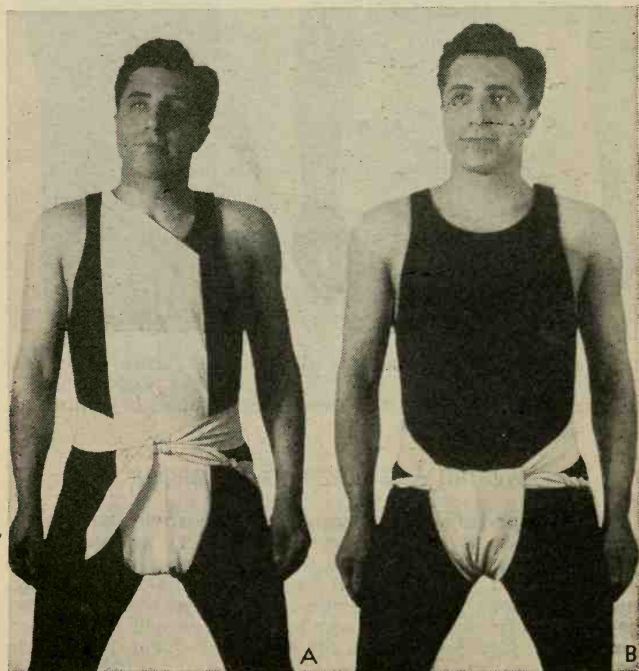


FIGURE 29.—Dressing for Wound of Crotch:
A, Partly applied; *B*, completed.



FIGURE 30.—A, Dressing for Wound of Hip; B, Dressing for Wound of Thigh.

WOUND AND BLEEDING OF HIP

Split the tails of a sterile bandage compress, place pad over the wound, pass top tails around the body, and tie over the opposite hip. Pass one end of the bottom tail around the front of the thigh and the other end over the buttock of the injured side crossing below the crotch, and continue around the thigh, tying on the outside. Cover with a triangular bandage, as follows: Place the base well up on the thigh, with the apex pointing toward the armpit, bring the ends around the thigh, and tie. Pass a cravat bandage around the body, and tie a single knot over the apex, fold the apex over the knot, and complete tying the knot (fig. 30, A).

WOUND AND BLEEDING OF THIGH

Apply the pad of a sterile bandage compress over the wound, pass the ends around the thigh, and tie over the pad. Cover with a cravat bandage by placing the center over the compress, pass the ends around the thigh, cross them, bring around again, and tie over the pad (fig. 30, B).

Control arterial bleeding of the thigh by temporary pressure at a pressure point above the wound, and apply a tourniquet.

DRESSING FOR AMPUTATED THIGH OR LEG

Control hemorrhage by digital pressure until a tourniquet is applied. Dress the stump with sterile gauze or gauze procured from a sterile bandage compress as described on page 18. Hold the dressing in place with a triangular bandage, as follows: Make a fold along the base of the triangular bandage, placing the stump in the center of the bandage; carry the apex over the stump to the front of the thigh, cross the ends at the front of the thigh, pass around the thigh, and tie at the front; then fold the apex over the knot, and tuck it under. Apply a similar dressing to the stump of a leg or foot.

WOUND AND BLEEDING OF KNEE

Apply the pad of a sterile bandage compress over the wound, and tie it firmly in place. Place the center of a cravat bandage over the pad. Bring the ends of the bandage around either side of the leg, cross them at the back of the knee, pull them forward, and tie them above the knee (fig. 31, A). Control arterial bleeding of the knee by temporary pressure, and apply a tourniquet at thigh pressure point.

WOUND AND BLEEDING OF LEG

Apply the pad of a sterile bandage compress over the wound, pass the ends around the leg, and tie over the pad. Place the center of a cravat bandage over the pad, pass the ends around the leg, cross on the opposite side of the leg, bring around again, and tie over the pad (fig. 31, B). Control arterial bleeding of the leg by temporary pressure, then apply a tourniquet at thigh pressure point.

BLEEDING FROM VARICOSE VEINS IN LEG

Varicose veins are enlarged veins, usually in the leg. Exertion may cause them to burst, and serious results may follow. Lay the person down, and elevate the affected leg. Rip or cut tight clothing or constrictions from around the leg, so that the injury may be seen. Apply the pad of a sterile bandage compress over the bleeding point, pass the ends around the leg, and tie over the pad. Place the center of a cravat bandage over the pad, pass the ends around the leg, cross on opposite side of the leg, bring around again, and tie over the pad (fig. 31, B).

WOUND AND BLEEDING OF ANKLE

Apply the pad of a sterile bandage compress to the wound, carry the ends around the ankle, and cross over the instep, around the bottom of the foot, then cross over the instep again, passing ends around the ankle, and tie the knot over

the pad. Place the center of a cravat bandage over the compress, and, passing one end over the instep under the bottom of the foot and over the instep, take the other end around the ankle, over the compress, and around the ankle a second time; bring the end crossing the instep around the back of the ankle above the heel, and tie the ends over the pad. Control arterial bleeding of the foot by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh (fig. 32, *A*).

WOUND AND BLEEDING OF FOOT

Apply the pad of a sterile bandage compress to the wound, carry the ends around the foot and ankle, and tie over the pad. Place the center of a cravat bandage over the compress, and carry the ends around the foot and ankle, ending in a tie as near the front of ankle as possible. Control arterial bleeding of the foot by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh (fig. 32, *B*).

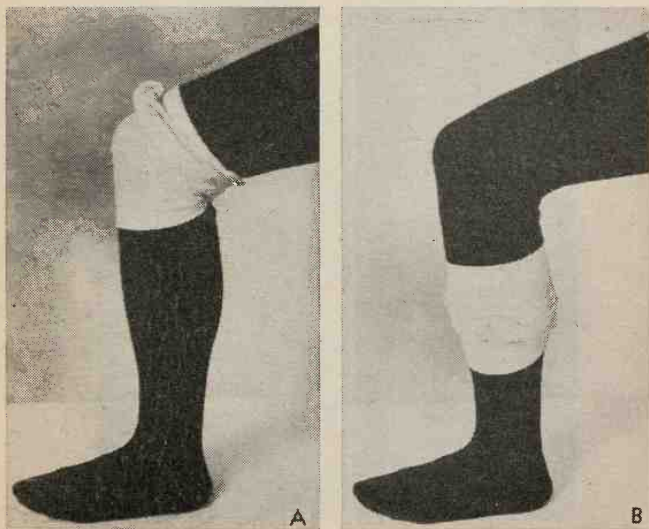


FIGURE 31.—*A*, Dressing for Wound of Knee; *B*, Dressing for Wound of Leg.

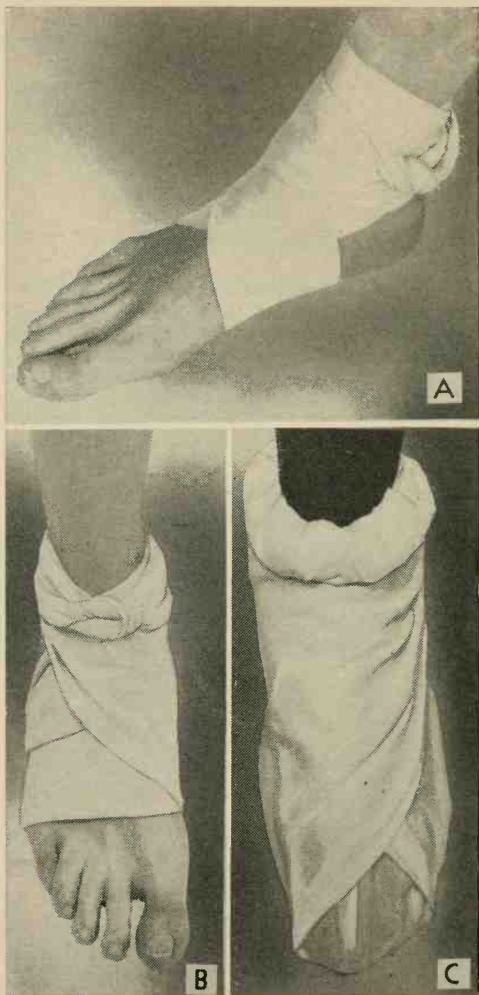


FIGURE 32.—Dressing for Wounds of:
A, Ankle and *B*, Foot; *C*, Dressing
for Extensive Wounds of Foot.

EXTENSIVE WOUNDS AND BLEEDING OF FOOT

Apply sterile gauze or the pad of a large sterile bandage compress over the wound, and tie it in place. Cover with an open triangular bandage in the following manner: Place the base of the triangle on the back of the ankle, and bring the apex under the sole of the foot, over the toes, back over the instep, and up the leg to a point above ankle in front; then pass the end on the little-toe side over the instep, then the other end over the instep, and continue around the ankle with both ends and tie in front. Bring the apex down over knot, and tuck it under (fig. 32, C). Control arterial bleeding of the foot by temporary pressure, then apply a tourniquet at thigh pressure point.

WOUND AND BLEEDING OF TOE

Apply the pad of a small sterile bandage compress over the wound, pass the ends around the toe several times, and tie them over the pad; or use a small adhesive compress. Remove the cover from the adhesive, place the pad around the toe, and press one end down smoothly; then bring the other end around the other side of the toe, drawing the compress so that it is snug. If over one toe is injured, apply a small bandage compress or adhesive compress to each toe, as directed above. Then apply a triangular bandage as described for extensive wounds and bleeding of foot. Control arterial bleeding of the toe by temporary pressure, then apply a tourniquet as for arterial bleeding of the thigh.

WOUND OF END OF TOE

Apply a small adhesive compress bandage, or apply the pad of a small sterile bandage compress over the wound. When two or more toes are injured, apply a small bandage compress to each, and cover with an open triangular bandage as described for extensive wounds of the foot (fig. 32, C).

Chapter VIII. BURNS AND SCALDS

Burns and scalds are injuries caused by dry heat, fire, or heated objects, electricity, friction, hot solutions, steam and vapors, and chemicals, such as strong acids or strong alkalis. Burns more commonly are the result of contact with dry heat, electricity, friction, and chemicals, whereas scalds more commonly are the result of contact with hot solutions, hot vapors, or steam. Electricity may cause burns either by current passing through the body or by electric flashes.

CLASSIFICATION OF BURNS

Burns are classified as to the degree of injury to body tissues as follows:

First Degree

The outer skin is reddened, and there is slight swelling.

Second Degree

The under skin is affected, and blisters are formed.

Third Degree

The skin is destroyed, and some tissues underneath are damaged. In severe cases, muscles, nerves, and blood vessels may be destroyed and the whole area charred.

The seriousness of a burn or scald is influenced by the extent of the body surface involved, as well as by the depth to which the tissues are penetrated. It is generally assumed that, where one-third of the surface of the body is injured by a second-degree burn or scald, death usually follows, but a much smaller area injured by a third-degree burn often endangers life.

Shock is very severe when burns are extensive and may cause death in a few hours. Shock is chiefly responsible for deaths that occur during the first day or two after burns.

TREATMENT OF BURNS AND SCALDS

Emergency or first-aid care of burns or scalds should primarily be exclusion of air from the burned area; relief of the pain that immediately follows burns; prevention of or minimizing the onset of shock and, if it occurs, giving prompt and effective treatment; and prevention of infection.

Remove all clothing from the injured area; but cut around any that adheres to the skin, and leave it in place. Keep the

patient covered, except the injured part, as there is a tendency to chilling. As soon as the burned or scalded area has been exposed, cover it by a protective dressing and a loosely applied cover bandage. The use of grease or oils in first-aid care may make necessary cleansing of the burned or scalded surfaces with a solvent before medical treatment can be begun. This delays the medical treatment and is very painful. Therefore, first-aid dressings for burns or scalds should be free from grease or oil.

Picric-acid gauze is one of the most popular burn dressings. It consists of sterile gauze impregnated with a $\frac{1}{2}$ - to 1-percent solution of picric acid, dried, and folded to fit into convenient sealed packages. It does not deteriorate and is easy to apply. To use it, remove the gauze from the package, carefully unfold it so as not to contaminate the part to be applied to the burned surface; moisten it with clean water, place it over the injured area, and hold it in place by a loosely applied bandage. To keep the gauze from drying, the cover bandage may also be kept moist. Several packages of picric-acid gauze can be used to cover a considerable area.

First-degree burns may be treated with preparations approved by a company or plant physician and kept in the first-aid kit. In or around the home, first-degree burns may be treated by applying gauze or bandages dipped in a solution of three tablespoonfuls of baking soda dissolved in a quart of water.

Be careful when dressing burns and scalds. Burned and scalded surfaces are subject to infection the same as open wounds and require the same care to prevent infection. Do not break blisters intentionally.

Never permit burned surfaces to be in contact, such as areas between the fingers or toes, the ears and the side of the head, the undersurface of the arm and the chest wall, the folds of the groin, and similar places. Always see that burn dressings separate these surfaces.

When picric-acid gauze is used, cover the entire area with sterile gauze before the cover bandage is applied. If a wound is present in the burned area, cover it with the burn dressing. Cover bandages should be loose enough to prevent pressure on burned surfaces. As swelling often takes place after burn dressings have been applied, check them frequently to see that they are not too tight. Watch for evidence of shock, and treat it if present.

Permit the patient to have all the water he will drink, but give it in moderate amounts at frequent intervals.

CHEMICAL BURNS

When a person has been burned by a chemical, wash the area thoroughly with clean water to dilute the chemical, and

then dress it as for a burn. Keep a continuous stream of cool water flowing over the burned area from a spigot or some container long enough to dilute the chemical. After 5 minutes or more of washing, the burn dressing may be applied.

BURNS OF EYE BY CHEMICALS

Frequently chemical substances, especially lime, cement, caustic soda, or acids or alkalies from storage batteries, get into the eye. The treatment is to wash the eye freely with cold water. To do this, have the patient lying down, hold his eyelids open with the fingers, and pour the water into the inner corner of the eye from a pitcher or other container. Use plenty of water, and wash the eye thoroughly, being sure the water actually flows across the eye. No neutralizing solution should be placed in the eye. After the eye has been washed, apply the dressing for injury of the eye (fig. 21, *B*, p. 55). Chemical burns of the eye should receive the attention of an eye specialist as early as possible.

BURNS OF FACE, HEAD, OR NECK

Apply picric-acid gauze or other burn dressing, making sure that the gauze is placed between raw surfaces of ears and head, and cover this with 2 triangular bandages and 1 cravat bandage, as follows: Place the base of a triangular bandage over the top of the head a little back of the center, the apex dropping over the face and under the chin. Cross the two ends back of the head below the bony prominence, pass them around the neck, and tie loosely over the apex under the chin. Place the center of the second triangular bandage over the top of the head, but somewhat in front of the center, the apex passing back over the head to the back of the neck. Carry the two ends under the chin, cross them, pass them around the neck, and tie them loosely at the back over the apex. Place the center of a cravat bandage under the chin, pass the bandage around the neck, crossing at the back of the neck, and tie in front (fig. 33, *A*). If dressings also are to be applied to the chest and back, leave the apex of the head and face bandages extending down the chest and back, placing them under the chest and back dressings. If the head and face only are burned, fold the apexes up, and tuck under bandage applied around neck. Cut a hole in the first triangular bandage over the patient's nose large enough for him to breathe freely. If the neck only is burned, dress it by applying picric-acid gauze or other burn dressing and covering with a cravat bandage as for wound and bleeding of neck.

BURNS OF SHOULDER

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with a triangular bandage held in place by a cravat bandage, as described for wound and bleeding of shoulder (fig. 22, A, p. 57).

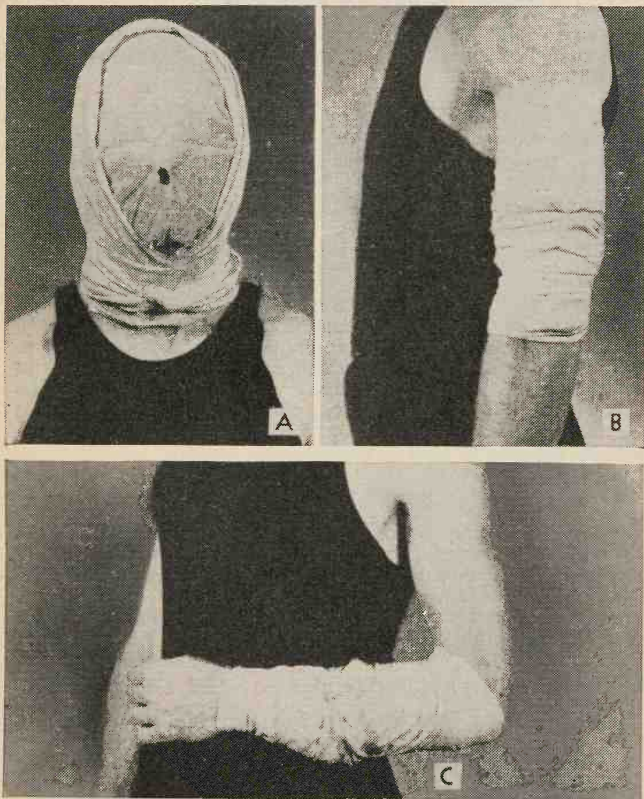


FIGURE 33.—A, Dressing for Burns of Face, Head, and Neck; B, Dressing for Burns of Arm; C, Dressing for Burns of Forearm.

BURNS OF ARM

Remove clothing from burned surfaces, apply picric-acid gauze or other burn dressing, and cover with a cravat bandage. Place the center of the bandage on the arm, take the ends around the arm, and tie on the outside (fig. 33, *B*).

BURNS OF FOREARM

Remove clothing from burned surfaces, apply picric-acid gauze or other burn dressing, and dress as for burns of the arm (fig. 33, *C*).

BURNS OF HAND

Place picric-acid gauze or other burn dressing over burned surfaces, prevent raw surfaces of the fingers from touching each other by placing gauze between them, then apply a triangular bandage as for extensive wounds and bleeding of the hand (fig. 25, p. 62).

BURNS OF BACK

Remove clothing from burned surfaces, and apply picric-acid gauze or other burn dressing. Split the apex of a triangular bandage just far enough to tie around front of neck. Place the base of bandage around the lower part of back, and tie in front (fig. 34, *A*). Dress small burns of the back with a triangular or cravat bandage as for wound and bleeding between shoulders (fig. 26, p. 63), or wound of the back, as the injury may indicate.

BURNS OF CHEST

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing. Split the apex of a bandage just far enough to tie at back of neck. Place base of bandage around the waist, and tie in back (fig. 34, *B*). Dress small burns of the chest with a cravat bandage, as for wound and bleeding of the chest (fig. 27, p. 64).

BURNS OF LOWER ABDOMEN, LOWER BACK, OR BUTTOCKS

Before dressing, remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with triangular bandages, as described for wound and bleeding of lower part of abdomen, lower part of back, or buttocks (fig. 28, p. 65).

BURNS OF HIP

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover with bandage as described for wound and bleeding of hip (fig. 30, *A*, p. 67).



FIGURE 34.—A, Dressing for Burns of Back; B, Dressing for Burns of Chest.

BURNS OF THIGH

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover as described for burns of the arm (fig. 33, B, p. 75).

BURNS OF LEG

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover as described for burns of the forearm (fig. 33, C, p. 75).

BURNS OF FOOT

Remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, making sure gauze is placed between raw surfaces of toes, and cover as described for extensive wounds of foot (fig. 32, C, p. 70).

COMPOSITE BURNS OF HEAD, FACE, NECK, BODY, AND EXTREMITIES

To dress any or all of the above, remove clothing from burned surfaces. Apply picric-acid gauze or other burn dressing, and cover the part or parts as described under the different headings (fig. 35).



FIGURE 35.—Dressing for Burns of Head, Face, Neck, Body, and Extremities.

Chapter IX. CLOSED WOUNDS; FOREIGN BODIES

CLOSED WOUNDS

Several types of injuries may be suffered where the skin is not broken but damage occurs to the deeper tissues; these injuries usually are classed as closed wounds.

BRUISES

Bruises are the most frequent injuries suffered. They are caused by some blunt instrument or object striking the body or by the body coming in contact with a hard object, as in a fall or a bump. Usually the skin is not broken, but the soft tissues beneath the skin are injured. Small blood vessels are ruptured, causing blood to seep into the surrounding tissues, which produces swelling, at first red but later turning darker to a blue or purple discoloration. If a larger blood vessel is broken, much blood gathers under the skin, causing greater swelling and discoloration.

The symptoms of bruises are immediate pain from injury to the nerves, swelling, rapid discoloration, and later pain on pressure or movement. A bruise may be only the external evidence of a more serious injury to deep-lying structures.

Treatment

The treatment should attempt to limit swelling and decrease pain. Apply cold applications, such as an ice bag or towel wrung out in cold water. Elevate the injured part, and place at complete rest. Make sure there is no other injury, such as a broken bone or dislocation. Severe bruises should have the care of a physician.

STRAINS

A strain is the overstretching of a muscle or a tendon of a muscle. In severe strains, the fibers forming the muscle or tendon may be torn. Strains are caused by sudden movements or by violent exertion in lifting or moving heavy weights.

The symptoms of a strain are a sharp pain or cramp immediately, and any attempt to use the muscle is difficult and painful. Moderate swelling may be present.

Treatment

Place the patient in a comfortable position, and apply hot applications (in treating most strains, dry heat is more effective than moist heat). Rub the part with warm alcohol or witch hazel to relieve pain; massage stimulates circulation

and prevents further venous congestion. Keep the part at rest.

The most frequent strain is that of the muscles of the back, caused by improper lifting or an attempt to lift too heavy objects. To prevent back strains when lifting and moving heavy weights, use the strong muscles of the legs and arms instead of the muscles of the back. When lifting an object from the ground, instead of stooping over by bending the back and waist, bend the knees but keep the feet as close together as possible. See that the body weight is evenly distributed on each foot, and keep the back straight. Rise by straightening the legs, thus making fullest use of the leg and arm muscles and taking most of the strain from the back and abdominal muscles. Do not attempt to raise or move weights that are too heavy; get assistance.

SPRAINS

Sprains are injuries due to stretching or tearing of the ligaments or other tissues around a joint. They are caused by a sudden twist or wrench. Sprains range from minor injuries causing pain or discomfort for only a few hours to severe cases where tearing of the tissues requires many weeks of medical care before normal use of the joint is restored.

The symptoms of sprains are pain around the joint and inability to use it. Swelling is usually rapid and marked, followed by discoloration.

Treatment

Place the joint at absolute rest in an elevated position. Use cold applications, such as compresses wrung out in cold water, ice packs, etc., to relieve pain. The joint may be bound firmly with a cravat bandage. Never attempt to strap a sprained joint with adhesive tape. Use of adhesive tape in caring for a sprained joint is beyond first aid and should be left to a physician.

Because of the great amount of swelling in some sprains, it is often difficult to determine whether the joint has been dislocated or whether a fracture has occurred in or near the joint. Such cases should receive medical attention, as they often require an X-ray examination to determine the extent of the injury. If in doubt as to the extent of the injury play safe, and treat it as a fracture.

Dressing for a Sprained Ankle

When an ankle has been sprained and it is necessary for the injured person to use the foot temporarily to reach a place for further care, the following dressing is beneficial:

Unlace the shoe, but do not remove it. Place the center of a narrow cravat bandage under the foot in front of the heel of the shoe. Carry the ends up and back of the ankle, crossing above the heel, and continue forward, crossing over the instep, and then downward toward the arch to make a hitch under

the cravat on each side, just in front of the heel of the shoe. Pull tight, carry the ends back up across the instep, and tie at the back of the ankle (fig. 36).



FIGURE 36.—Dressing for Sprained Ankle.

RUPTURE OR HERNIA

Rupture or hernia is protrusion of a portion of an internal organ, usually the bowel, through the muscular wall of the abdomen. Most ruptures occur in or just above the groin, although ruptures may occur at other places over the abdomen. Ruptures are caused by muscular strains from lifting or pushing, violent coughing, sudden jars in jumping, and similar acts.

The symptoms of a rupture are a sharp, stinging pain and the feeling of something giving way at the site of the rupture. On examination swelling is found ranging in size from that of a marble to that of the doubled-up fist, or even larger. The swelling is usually tender. Nausea and vomiting often occur.

Treatment

Lay the patient on his back with knees well drawn up, place the center of a cravat bandage on the outside of the thighs, and pass the ends around the thighs, crossing under the bend of the knees. Bring the ends around the legs just above the ankles, and tie in front. Then support under knees with padding. Pass another cravat bandage underneath the padding; bring the ends up around the thighs, and tie (fig. 37). In this position, the protrusion may slip back

through muscles into the abdominal cavity. If the swelling remains, apply ice or cold applications, and procure medical assistance. Gentleness is necessary in handling the protrusion. Never attempt to reduce the swelling, as serious damage may be caused to the bowel or its covering. If the patient has to be removed, transport him lying on his back with the knees drawn up and supported with plenty of padding. All cases of rupture should have medical attention. For proper method of lifting to prevent ruptures, *see* page 30.



FIGURE 37.—Dressing for Rupture.

FOREIGN BODIES

FOREIGN BODIES IN EYE

Foreign bodies, such as particles of dirt, sand, cinders, coal, emery dust, or fine pieces of metal, frequently are blown or driven into the eye and lodge there. They not only cause a feeling of discomfort but, if not removed, set up inflammation that may lead to infection. Fortunately, through an increased flow of tears, nature dislodges many of these substances before any harm is done. In no case should the eye be rubbed, as rubbing may cause scratches of the delicate eye tissues or force a foreign particle with sharp edges into the tissues, making its removal difficult.

The tissues of the eye are very delicate and can be damaged seriously by rough or improper methods of attempting to remove foreign bodies. It is always safer to send the patient to a physician who has the necessary training and equipment to care for such cases than for a first-aid man to attempt to remove foreign objects.

Treatment

Sometimes a foreign body lodged under the upper lid may be removed by drawing the upper lid down over the lower lid; as the upper lid returns to its normal position, its under

surface will be drawn over the lashes of the lower lid and the foreign body removed by the wiping action.

Another method is to expose the under surface by grasping the eyelashes between the thumb and forefinger of one hand and turning the lid up over the tip of the finger or over a match or pencil; the particle may then be removed carefully with a corner of a piece of folded sterile gauze.

Particles lodged under the lower lid may be removed if the lower lid is pulled down, exposing the inner surface.

Should a foreign body become lodged on the eyeball, do not attempt to disturb it, as it may be forced into the eye and cause a serious condition. Place a bandage compress over the eye (fig. 21, *B*, p. 25), and send the person to a doctor at once. Removal of particles embedded in the eyeball requires skill, and the abrasion caused thereby should have medical care to prevent infection.

Gentleness in handling eye injuries is absolutely essential. Never use the point of a knife blade, a toothpick, or a sharpened matchstick to try to dislodge a foreign body in the eye. If difficulty is experienced in removing the foreign body from the eye, send the patient to a doctor at once. Wearing proper goggles not only prevents wounds of the eyes but keeps foreign particles from entering them; also see *Burns of Eyes*, page 74.

FOREIGN BODIES IN EAR

Small insects or pieces of coal or other material may get into the ear. Other objects, such as kernels of corn, peas, buttons, or seeds, are sometimes put in the ears by children. Such substances as seeds absorb moisture and swell in the ear, making dislodgment difficult and often causing painful inflammation.

Treatment

Pins, hairpins, or pieces of wire should never be inserted in the ear to dislodge foreign bodies, as they may damage the tissues lining the ear or pierce the ear drum. Insects entering the ear may be killed by turning the ear up and dropping sweet oil, olive oil, or mineral oil warmed to body temperature into it. After the oil has been in the ear several minutes, turn the head so the ear is down; the suffocated insect usually will float out with the oil as it runs from the ear.

Foreign bodies that cannot be removed readily from the ear should receive medical attention.

FOREIGN BODIES IN NOSE

Foreign bodies in the nose usually can be removed without difficulty but occasionally require the services of a physician.

Treatment

Sneezing induced by snuff or pepper or tickling the opposite nostril with a feather usually will dislodge foreign bodies from the nose. Do not blow the nose violently or with one nostril held shut.

FOREIGN BODIES IN THROAT OR WINDPIPE

Pins, coins, fishbones, false teeth, and particles of food often become lodged in the throat or windpipe. Although as a rule there is not complete obstruction of the air passages, more or less severe symptoms of suffocation are present. The victim's face becomes livid, and he gasps for breath, with violent fits of coughing. Particles of food frequently are sucked into the windpipe by sudden inspiration while eating. A person should be careful not to laugh while he has anything in his mouth.

Treatment

In all cases, an attempt should be made at once to remove the obstruction. Have the patient open his mouth wide, facing the light. Hold the tongue down, and look into the throat. Often the object can be seen. Pass the forefinger into the throat alongside of the tongue, and try to withdraw the object. Take care not to push the object farther into the throat or windpipe.

Foreign bodies that are down so deep they cannot be seen or felt with the finger may be dislodged by coughing or by slapping the person on the back between the shoulder blades. If this fails, place him in an inverted position so that he "stands on his head" and slap him sharply between the shoulder blades with the hope of dislodging the substance, aided by gravity. Hold young children up by the legs with the head down, and slap them as above to dislodge foreign bodies from the throat or windpipe.

If foreign bodies cannot be removed by the above methods, send for a physician at once. Meanwhile, if there is serious interference with breathing, perform artificial respiration.

FOREIGN BODIES IN STOMACH

Foreign bodies, such as pins, coins, nails, and other articles, sometimes are swallowed accidentally or, as in the case of small children or the insane, deliberately. They may lodge in the gullet or tube leading to the stomach and cause difficulty in swallowing, but more often they pass directly into the stomach.

Treatment

Do not attempt to dislodge foreign bodies from either the gullet or the stomach. Do not give anything to cause vomiting or to move the bowels. Consult a physician immediately, and leave the treatment to him.

Chapter X. FRACTURES AND DISLOCATIONS

FRACTURES

The framework on which the human body is built consists of bones of various sizes and shapes that form the skeleton. A broken bone is called a fracture. There are many types of fractures, but in first aid they are divided into two groups, simple and compound.

In simple fractures the bone is broken, but no wound extends from the broken ends of the bone out through the skin. Usually in simple fractures there is no considerable displacement of the ends of the broken bone (fig. 38).

In compound fractures the bone is broken, and a wound extends from the bone out through the skin. The wound in a compound fracture may be caused by one or both ends of the broken bone being forced out through the tissues and skin or by some object piercing the skin and tissues to the bone and breaking it (fig. 38).

Broken bones, especially the long bones of the arms and legs, often have sharp, sawtooth edges; even slight movement may cause the sharp edges to cut into blood vessels, nerves, or muscles, and perhaps through the skin. Therefore, by careless or improper handling a simple fracture can be converted into a compound fracture, or by damage to surrounding blood vessels or nerves the injury can be made much more serious. A person handling a fracture should always bear that in mind. Damage due to careless handling of a simple fracture may greatly increase pain and shock, cause complications that will prolong the period of disability, and endanger life through hemorrhage of pierced blood vessels.

The general symptoms of fractures are:

- (1) Pain in the region of the fracture.
- (2) Loss of function in the case of long bones.
- (3) Deformity or irregularity of the part.
- (4) Moderate or severe swelling.
- (5) In fractures of the extremities the limbs usually are shortened.

Be careful when examining injured persons, particularly those apparently suffering fractures. Do not attempt to change the position of an injured person until you have made a careful examination. Do not permit a person to sit up until you have examined him and know that changing position will not complicate his injuries. If a person is lying down, it is far better to dress his injuries in that position with as little movement as possible. If fractures are present, make any necessary movement in a manner to protect the injured part against further injury.

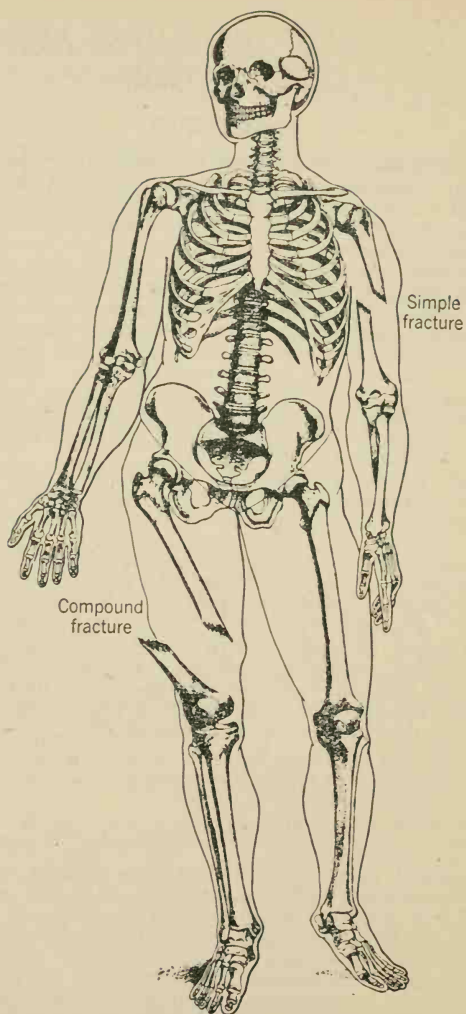


FIGURE 38.—Simple Fracture and Compound Fracture.

In fractures of the extremities, cautiously place the limb in as nearly a natural position as possible by grasping its lower part well below the fracture but not pulling on the limb, while an assistant supports the under part of the limb on either side of the break. Then apply appropriate padded splints, being sure to place extra padding under all hollow spaces, such as knee, ankle, wrist, etc.

Support all fractures except those of the skull, nose, upper and lower jaw, cheekbone, shoulder blade, and ribs until dressing has been completed.

Apply a tourniquet to a compound fracture before the limb is moved. If there is arterial bleeding, tighten the tourniquet; otherwise leave it in place, loose but ready to be tightened if arterial bleeding occurs while the limb is being handled and the splints applied. Dress the wound with a sterile bandage compress and cover bandage as previously described for wound and bleeding of that location. Do not tie the knots of the bandage compress and cover bandage over the wound. Where the bones of a fracture are so located as to come in contact with the splint arrange the padding of the splint so that the wound area is well-arched to prevent pressure over the ends of the broken bone and also around the tourniquet so that it can be tightened or loosened freely. Insofar as possible, apply splints to fractures or suspected fractures before the patient is moved.

Shock usually follows fractures; treat for it as soon as possible. Obtain medical care promptly for all fractures.

SPLINTS

Splints are used to support and protect injured parts, such as fractures, dislocations, or suspected broken bones, and to prevent movement at the point of fracture and at the nearest joint. They must be of stiff material. Improvised splints may be made from pieces of wood, broom, pick or shovel handles, mine augers, drills, rules, laths, heavy cardboard, canes, umbrellas, sprags, cap boards, newspapers, magazines, or other similar material.

In making a splint for a fracture always remember that, besides being firm and stiff, it should be long enough to prevent movement at the joints on both sides of the fracture and that, if possible, it should be as wide as the thickness of the limb to which it is applied. Pad splints well with some soft material on the inner side and at the ends that come in contact with the body; place extra padding under all hollow spaces, such as the knee, ankle, and wrist.

PLACING BANDAGES FOR SPLINTS

To facilitate the placing of bandages, use a thin stick or splint. Natural arches afford enough clearance where the

bandages may be slipped under the body or limbs. After the bandages have been passed under, move them gently up or down to the position in which they are to be tied.

If the loop or St. John's tie is to be used, pass the bandage under the part doubled. Hold the ends of the cravat at one side of the splint, and draw the loop to the point where it is to be tied, usually near the outside edge of the splint. Pass 1 end through the loop in one direction and the other end through the loop in the opposite direction; then bring the 2 ends together on the outside of the loop, draw the bandage tight, and then tie with a square knot. The loop or St. John's tie may be used in applying splints to the lower extremities, except ties at the knee in fractures of the kneecap and for fractures of the foot. In very few exceptions, mentioned in the dressing for particular fractures, tie the bandages securing splints away from the splints.

FRACTURE OF SKULL

A fracture of the skull is a break in its bony structure and may occur on the top, front, sides, or back of the head. A fracture of the skull is always serious because of possible injury to the brain. The skull may be fractured without visible wound of the scalp.

The injured person may or may not be conscious. If the fracture is at or near the base of the skull, a mixture of blood and serum may flow from one or both ears. Bleeding from the mouth and nose and into the eyes also may be present. If the pupils of the eyes are unequal in size, the brain has been damaged either by pressure or by hemorrhage into it. Concussion of the brain may be confused with fracture of the skull, but as the care of both is much the same there is no need to distinguish them. All serious injuries to the head should be considered possible fractures of the skull, and if doubt exists treat them as such.

Treatment

Keep the patient lying down with his head raised by a pad. Turn the head to such a position that it rests away from the location of the suspected fracture. If a wound is present, control bleeding, and dress it. Tie the knots of the bandage compress and cover bandage away from the wound to prevent pressing fragments of bone into the brain. Cold applications may be applied to the head in the region of the fracture. Keep the patient warm, and treat for shock, which is usually severe. **Never** give a stimulant. In all severe head injuries keep the patient lying down. Where the patient has been unconscious, even for a short time, do not permit him to get up until he has been examined by a physician. Obtain medical care promptly.

FRACTURE OF NOSE

A fracture of the nose seldom is difficult to detect because of the deformity. Such a fracture may be simple or compound. The symptoms are pain, bleeding, swelling, and deformity.

Treatment

Apply a bandage compress, not too tight, as for wound of the nose (fig. 21, *C*, p. 55).

FRACTURE OF UPPER JAW OR CHEEKBONE

Treatment

In fractures of the upper jaw or cheekbone, where there are open wounds, treat as for wounds of the face (fig. 20, *C*, p. 54). No dressing is needed, in the absence of an open wound, but the patient should receive medical attention promptly.

FRACTURE OF LOWER JAW

In a fracture of the lower jaw the mouth is usually open, and saliva mixed with blood flows from one or both corners of the mouth. Talking is painful and difficult. The teeth of the lower jaw are uneven at the break, with some teeth loosened or knocked out.

Treatment

Gently place the jaw in position so that the lower teeth are against the upper teeth. Place the center of 1st cravat bandage over the front of the chin, and pass the ends around to the back of the head and tie, leaving the ends long. Place the center of 2d cravat bandage under the chin, pass the ends over the cheeks to the center of the top of the head, and tie,

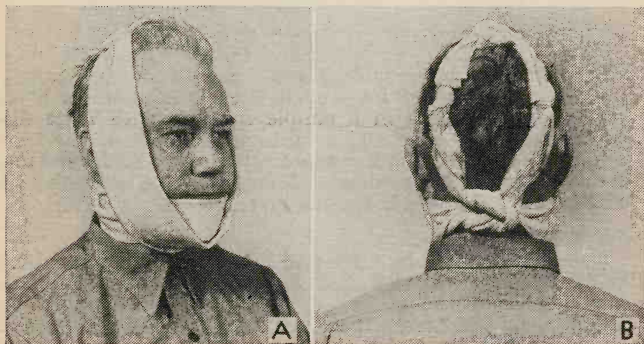


FIGURE 39.—Dressing for Dislocation or Fracture of Lower Jaw: *A*, Front view; *B*, back view.

leaving the ends long. Then bring the ends of the two bandages together, and tie them separately (fig. 39).

FRACTURE OF COLLARBONE

Fracture of the collarbone frequently is caused by a fall with the hand outstretched or by a blow on the shoulder. The arm of the injured side is partly helpless, and the injured shoulder is lower and tends to droop forward. The patient frequently keeps his forearm bent across the chest and supports the injured arm at the elbow with the other hand. An irregularity can be seen and felt along the fractured collarbone.

Treatment

Place a pad about 3 inches thick, 4 inches wide, and 5 inches long beneath his arm, extending from the armpit down. Place the center of a narrow cravat bandage on the outside of the arm just below the shoulder, and carry around arm and pad just below the armpit to the back of the arm; then cross the ends, carry both ends across the back to the opposite shoulder, carry one end over the shoulder and the other end under the armpit, and tie on the front of the shoulder over a pad. This bandage should be tight enough to pull back the shoulder on the injured side. Place the center of a second cravat bandage on the outside of the arm just above the elbow on the injured side, carry around the arm and the body (one end across the chest and the other end across the back), and tie over a pad on the injured side. Place the arm in a triangular bandage sling with the hand raised about halfway up the chest (fig. 40). An assistant should support the arm while the dressing is being applied.

FRACTURE OF SHOULDER BLADE

Fracture of the shoulder blade is not a common injury. It usually is caused by a direct blow over the shoulder blade and generally results in a simple fracture with little displacement. The signs and symptoms are pain at the fracture, swelling, and inability to swing the arm backward and forward from the shoulder. There may be difficulty in locating the exact site of the fracture.

Treatment

Place the forearm in a triangular bandage sling, and bind the arm securely to the chest with a wide cravat bandage extending from the point of the shoulder downward by carrying one end across the chest and the other end across the back, and tie under the opposite armpit (fig. 41, A). Place a pad under the knot.

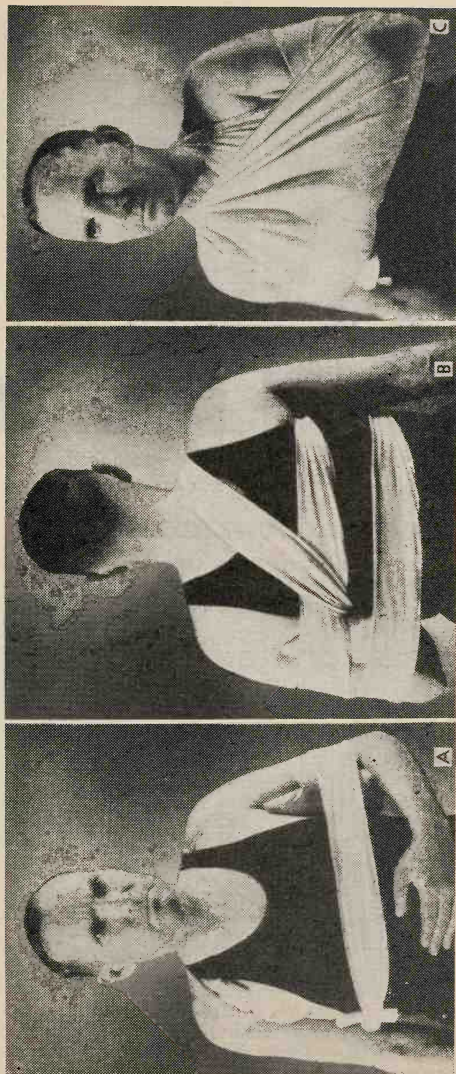


FIGURE 40.—Dressing for Fracture of Collarbone:

A, Dressing applied, front view, without triangular sling; *B*, dressing applied, rear view, without triangular sling; *C*, complete.

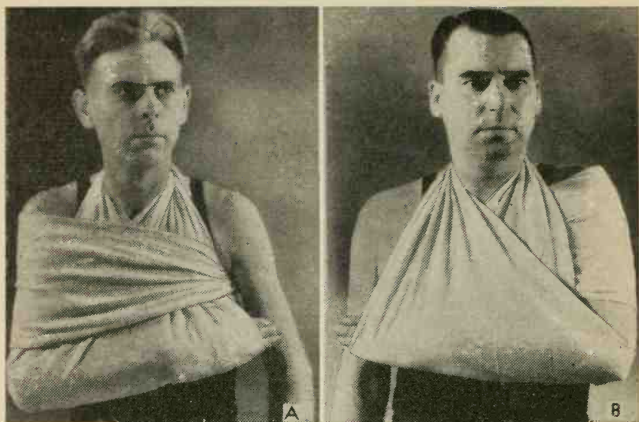


FIGURE 41.—A, Dressing for Fracture of Shoulder Blade; B, Dressing for Fracture of Upper Third of Arm.

FRACTURE OF UPPER EXTREMITY

Fracture of the arm, elbow, forearm, or wrist usually can be recognized by the pain at the fracture, swelling, deformity, and inability to use the arm below the point of fracture.

FRACTURE OF UPPER THIRD OF ARM

It is difficult to immobilize a fracture of the upper third of the arm bone. Bind the arm to the chest with a wide cravat bandage, extending from the point of the shoulder downward. Carry the bandage around the arm and body, one end across the chest and the other across the back. Tie over a pad on the opposite side of the chest. Place the forearm in a triangular bandage sling (fig. 41, B). If the fracture is a compound one, apply a tourniquet in the armpit, and dress the wound before dressing the fracture.

FRACTURE OF LOWER TWO-THIRDS OF ARM, ELBOW, FOREARM, OR WRIST

Treatment

A splint for any of the above-mentioned parts is made of two pieces of board $\frac{1}{4}$ inch thick and 4 inches wide. One piece should be long enough to extend from 1 inch below the armpit to the point of the elbow and the other long enough to extend from the point of the elbow to 1 inch beyond the end

of the middle finger. Fasten these boards together securely to form an L-shaped splint, and pad it well. Apply a well-padded splint to the inner side of the arm and forearm after the forearm has been bent across the chest. Use four cravat bandages to hold the splint in place, and tie them in the following order, regardless of the location of the fracture: Place the center of 1st cravat bandage on the outside of the arm at the upper end of the splint, pass around the arm one or more times, and tie on outside. Place the center of 2d cravat bandage on the arm just above the elbow, and apply in similar manner. Place the center of 3d cravat bandage on the forearm just below the elbow, and apply in similar manner. These three bandages are started and tied on the outside of the arm.

Apply 4th cravat bandage by placing the center of the bandage on the back of the wrist, passing the ends around and crossing on the splint under the wrist; bring one end up around the little-finger side, passing over the back of the hand and down between the forefinger and thumb; pass the other end up over the thumb, and cross it over the back of the hand down around the little-finger side; then cross both ends on the splint, and tie on top of hand. Place the forearm in a cravat-bandage sling (fig. 42, A). If the fracture is a compound one, apply a tourniquet in the armpit, and dress the wound before applying the splint.



FIGURE 42.—A, Dressing for Fracture of Lower Two-Thirds of Arm, Elbow, Forearm, or Wrist; B, Dressing for Fracture or Crushing of Bones of Hand or Fingers.

FRACTURE OR CRUSHING OF BONES OF HAND OR FINGERS

Treatment

In caring for the above injuries, apply a well-padded splint about $\frac{1}{4}$ inch thick, 4 inches wide, and long enough to reach from the point of the elbow to 1 inch beyond the end of the middle finger. Apply the splint to the inside of the forearm and hand by 1 cravat and 1 triangular bandage. Place the center of the cravat on the outside of the forearm just below the elbow, pass it around the forearm one or more times, and tie it on the outside of the forearm. Place the base of a triangular bandage under the splint at the wrist, bring the apex around the end of the splint over the hand to a point above the wrist, carry one end on the little-finger side across the back of the hand and wrist and the other end over the thumb side across the back of the hand and wrist, and cross the ends on the inside of the wrist, bringing them to the back of the wrist, and tie. Bring the apex down over the knot, and tuck it under. Place the forearm in a cravat-bandage sling (fig. 42, B).

If the fracture is a compound one, apply a tourniquet at the pressure point on the arm, and dress the wound before applying a splint.

FRACTURE OF FINGER

The usual symptoms of fracture of the finger are pain, swelling, and deformity.

Treatment

Place a narrow-padded splint under the broken finger and palm of the hand, and hold the splint in place by narrow strips of cloth. Pass one strip around the splint and the palm of the hand, and tie over the splint. Pass one strip around the finger and splint above the fracture, and tie over the splint. Pass one strip around the finger and splint below the fracture, and tie over the splint. Place the hand in a cravat bandage sling. If the fracture is a compound one, control bleeding, if necessary, at the pressure point on the arm, and dress the wound. Where two or more fingers are fractured, dress as for a fracture or crushing of bones of hand or fingers.

FRACTURE OF RIB

Fracture of the rib usually is caused by a direct blow or by a severe squeeze and can occur at any point along the rib. The symptoms are severe pain on breathing, tenderness over the fracture, and inability to take a deep breath on account of the pain. In a thin person the fracture may be seen under the skin. Grating sometimes can be felt by placing the hand over the seat of the fracture. If the lung of a person has been punctured by a fractured rib, he may cough up frothy blood.

Treatment

Use three cravat bandages to dress a fracture of the ribs. Locate the fracture, place the center of 1st cravat bandage over the fracture, carry the ends around either side of the body to the uninjured side, and tie over a pad in a single knot. Place the center of 2d cravat bandage over the fracture; and, overlapping the upper half of the first bandage, carry the ends around the body, and tie over the pad in a single knot. Place the center of 3d cravat bandage over the fracture, overlapping the lower half of 1st bandage, carry the ends around the body, and tie over the pad in a single knot. Then grasp the tails of 1st bandage, have the patient exhale, and tighten the bandage, completing the square knot. Follow this procedure with 2d and 3d bandages in that order (fig. 43).



FIGURE 43.—Dressing for Fracture of Rib.

FRACTURE OF SPINE

Fracture of the spine or backbone may occur at any point along the spinal column between its junction with the head at the top or its junction with the pelvic basin below.

In many cases of fracture of the spine, the spinal cord is injured. Where portions of the broken vertebrae are displaced, the spinal cord may be cut, or pressure may be made

on the cord. There may be deformity of the backbone, or the back may show little deformity (fig. 44, A).

The back may be broken and the injury cause no damage to the spinal cord, but if the injured person is permitted to sit up or is improperly handled sections of the spinal column may be displaced, and the spinal cord may be severely damaged. All questionable injuries to the back, even in the absence of signs of paralysis, should be treated as for fracture of the spine.

Treatment

When the spinal cord is cut or subjected to pressure, paralysis of the body occurs below the fracture. In all severe injuries to the back or neck **never** move the injured person until you have determined whether the neck or back is broken.

If the patient is conscious, ask him to move his legs and arms. If he cannot move his legs, and they are not fractured or dislocated, probably his back is broken, and the spinal cord is cut or pressure is being exerted on it. If he cannot move his arms as well as his legs and they are not fractured or dislocated, his spinal column is fractured high up, probably in the neck region.

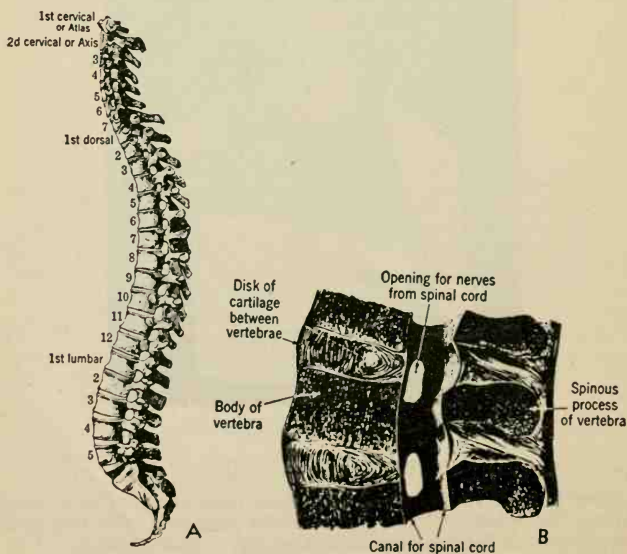


FIGURE 44.—A, Spinal Column; B, Section Through Several Vertebrae.

Paralysis may be determined in an unconscious patient by pinching or by sticking a pin or point of a knife blade into the soles of feet and palms of hands. If he is not paralyzed, a reflex muscular action draws the hand or foot away from the pinched area or from the pointed object. If there is no reflex muscular action in the feet, the back is broken below the neck, and if there is no reflex muscular action in the hands, the neck is broken. Sterilize the pin or knife blade used by dipping it in an antiseptic solution or by holding it in the upper portion of the flame of a match for about 10 seconds.

BROKEN NECK

Treatment

Always apply a splint for a broken neck with the patient lying on his back. If he is found lying face down or on his side, turn him on his back, using extreme care to keep his head on a line with his back and to prevent any movement of the neck whatsoever.

Construct the splint used for broken neck or broken back of two long boards, each 7 feet long, 6 inches wide, and 1 inch thick and three short boards, each 22 inches long, 4 inches wide, and 1½ inches thick. Place 1st short board at a point corresponding to the shoulders of the patient (about 15 inches from the end of the long boards). Place 2d short board at a point corresponding to the patient's hips. Place 3d short board at a point corresponding to the patient's heels. Nail or tie the long boards to the crosspieces securely, leaving a space between the long board in the center about 2 inches wide. Test the splint before a patient is placed on it.

For a broken neck, pad each long board separately with blankets, canvas, or clothing. A rolled-up single blanket tied on each long board of the splint provides the most effective padding.

In lifting the patient, raise him only high enough to push the splint under him, and take particular care to support his head, neck, and shoulders to prevent movement in that region. Never raise his head, but keep it at all times on a level with the body. When the patient has been placed on the splint, continue to keep his head level with the body, and place extra padding on each side of his head and neck to prevent turning or sidewise movement. Hold the head and padding level with the body until supporting bandages, at least 5th bandage, is applied.

Tie the body to the splint with 15 cravat bandages, as follows: Pass 1st bandage around the forehead padding and splint, and tie on the outer side of the splint. Pass 2d bandage around the splint and padding at the chin, and tie on the outer side of the splint. Pass 3d bandage around the body and splint well up in the armpits, and tie on the outer side of the splint. Pass 4th bandage around the body and splint

at the lower part of the chest, and tie on the outer side of the splint. Pass 5th bandage around the body and splint at the hips, and tie on the outer side of the splint. Place the center of 6th bandage well up on the shoulder, passing one end between the long boards under the neck, continuing under the crosspiece, completing the tie at upper edge of splint under the armpit. Tie 7th bandage in a similar manner around the other shoulder. Pass 8th bandage around one hip and crotch and crosspiece between long boards, and tie on the outer side of the splint. Apply 9th bandage in a similar manner around the other hip. Pass 10th bandage around the upper part of one thigh and the long board on that side, and tie on the outer side of the splint. Apply 11th bandage on the other side in a similar manner. Pass 12th bandage around the leg and long board on that side just below the knee, and tie on the outer side of the splint. Apply 13th bandage on the other side in a similar manner. Pass 14th bandage around one ankle and the long board on that side, and tie on the outer side of the splint. Apply 15th bandage on the other side. Tie all bandages around the body on the same side (fig. 45, A). If the patient is unconscious, fold his forearms, and tie them across his chest, as shown in figure 7, page 20. Cover the patient with a blanket, and treat for shock. The splint



FIGURE 45.—A, Dressing for Fracture of Neck; B, Dressing for Fracture of Back.

prepared as described above will serve as a stretcher, particularly on heavily inclined or vertical passageways. On level ground, it may be more comfortable for the patient and facilitate transportation to securely fasten the splinted patient to a standard stretcher. The patient should have medical attention as promptly as possible.

BROKEN BACK

Treatment

Place a patient with a broken back on the splint face down. Use the splint described for a broken neck, with additional padding. Tie a blanket folded several times over the padding on the long boards, so that only the upper part of the chest rests on it. Tie padding of equal thickness over the padding on each long board, extending from the crotch downward to the ankles.

When the patient is found lying face down, raise him carefully, with enough support to prevent any movement of the back and only high enough to push the splint under him. Apply the splint with 13 bandages, in the same order as those for a broken neck, except that the bandage around the padding and the head and the bandage around the padding and the chin are omitted. The anchor bandages over the shoulders may be tied by beginning the center of 4th and 5th bandages just below the top of the shoulder, passing 1 end between long boards under chin, passing 1 under the cross-piece, and completing the tie at the upper edge of the splint under the armpit.

If the patient is found lying on his back, do not attempt to turn him over until the splint is applied. Apply the splint to the front of the body (on top of the patient), tying the bandages in their regular order, except the anchor bandages around the shoulders. Bind the forearms to the sides of the body with a cravat bandage temporarily. Then gently lift, and slowly turn, the patient and splint to the face-down position. Next, place the shoulder anchor bandages. Test all bandages to make sure that they are tight enough. The forearms should be untied after the patient has been turned over, for convenience in tying anchor bandages at the shoulders and testing tightness of bandages; but they should be tied again, with crossed hands resting under his forehead, when the patient is unconscious (fig. 45, *B*). If the patient is found lying on his side, turn him carefully so as to be face down. Extend his arms above his head, and straighten his body before attempting to turn him. Support the entire back, with the turning movement exerted at the shoulders and hips simultaneously. Test the splint before the patient is placed on it. Cover the patient with a blanket, and treat for shock. The splint will serve as a stretcher, if necessary,

but it is safer to transport him on a standard stretcher. See that the patient has medical attention as promptly as possible.

FRACTURE OF PELVIS OR HIP

Fracture of the pelvis or hip usually results from a squeeze through the hips or a direct blow. Much importance is attached to the injury because so frequently it is accompanied by rupture of the bladder.

Treatment

The symptoms of this fracture are not easily detected; therefore, when an injured person complains of great pain through the pelvis, keep him lying on his back, supporting the pelvic region. Place the center of a wide cravat bandage over one hip, the upper end extending about 2 inches above the crest of the hip bone. Pass the ends around the body, and tie over a pad on the opposite hip. In like manner, place a second wide cravat bandage over the opposite hip, carry the ends around the body, and tie over the first bandage applied. Raise the patient only high enough to place him on a well-padded broken-back splint or a board about 7 feet long, 12 inches wide, and 1½ inches thick. If he is lying face down, apply the splint before turning him over. When a broken-back splint is used, tie the body to the splint with eight cravat bandages as follows: Pass the 1st cravat bandage around the splint and the upper part of the chest, well up in the armpits, and tie on one side near the splint. Pass 2d cravat bandage around the splints and the lower part of the chest, and tie near the splint. Pass 3d and 4th cravat bandages around the splint and each thigh, just below the crotch, and tie on the outside near the splint. Pass 5th and 6th cravat bandages around the splint and each leg, just below the knees, and tie on the outside near the splint. Pass 7th and 8th cravat bandages around the splint and each ankle, and tie on the outside near the splint (fig. 46, A).

When a board is used instead of a broken-back splint, do not bandage each leg separately, but pass the bandages over both limbs and tie them near the board (fig. 46, B). Pad well between the legs to prevent movement before the bandages are applied. Test the broken-back splint or board before placing the patient on it. Treat the patient for shock, and get him to the doctor or a hospital at once, as an operation for rupture of the bladder offers hope of success only in the first hour or two. If the patient is unconscious, pass a cravat bandage around the head and splint or board and tie it. Also tie the forearms folded across the chest, as described on page 20 (fig. 7). Transport the patient on a standard stretcher.



FIGURE 46.—Dressing for Fracture of Pelvis:
A, Using broken-back splint; B, using wide board.

FRACTURE OF LOWER EXTREMITY

Fracture of the thigh, knee, leg, or ankle usually can be recognized by the pain at the fracture, swelling, deformity, and inability to use the part below the point of fracture.

Treatment

The splint for fractures of the lower extremity from the hip down, except the foot, consists of one piece of board 6 inches wide, 1 inch thick, and long enough to extend from the top of the shoulder to 3 inches beyond the heel. Pad the splint well, preferably with a folded blanket. Carefully raise the injured side of the person while the fracture is being supported, and place the splint under the body and leg. Apply the splint with seven cravat bandages for a fracture of the thigh, knee, kneecap, or ankle. For a fracture of the leg place an extra bandage, if needed, between the knee and ankle.

The broken-back splint may be used for fractures of lower extremities, usually to good advantage.

FRACTURE OF THIGH, KNEE, OR ANKLE

Treatment

With 1st cravat bandage, make one wrap of the upper end of the splint and padding opposite the armpits, crossing beneath the splint, with a short end on the injured side. This can be done best before the splint is placed under the patient.

Pass the long end (an addition may be needed) around the body well up in the armpits, and tie to the short end on the injured side near the splint. Pass 2d cravat bandage around the lower part of chest and splint, and tie on the injured side near the splint. Pass 3d cravat bandage around the body and splint at the hips, and tie on the injured side near the splint. Pass 4th cravat bandage around the thigh and splint just below the crotch, and tie on the outside near the splint. Pass 5th cravat bandage around the thigh and splint just above the knee, and tie on the outside near the splint. Pass 6th cravat bandage around the leg and splint just below the knee, and tie on the outside near the splint. Pass 7th cravat bandage around the ankle and splint, and tie on the outside near the splint (fig. 47, A).

The order of applying bandages for fractures of the lower extremity is the same from the top down.

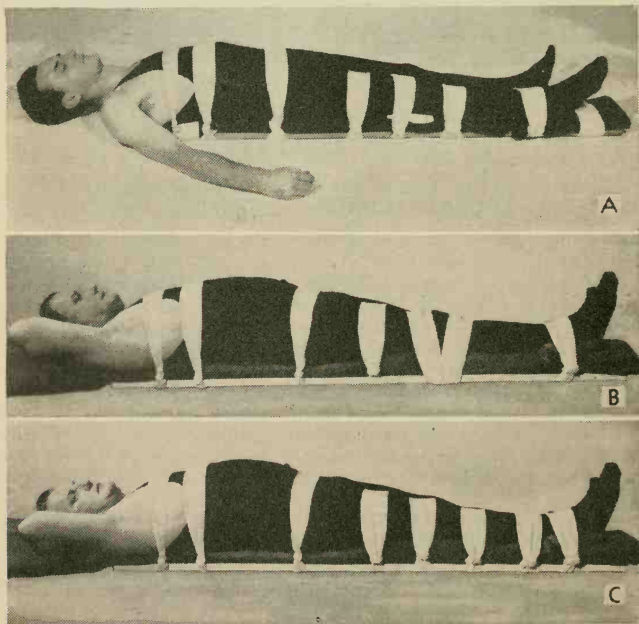


FIGURE 47.—A, Dressing for Fracture of Thigh, Knee, or Ankle; B, Dressing for Fracture of Kneecap; C, Dressing for Fracture of Leg, Showing Use of Extra Bandage.

FRACTURE OF KNEECAP

Treatment

In fracture of the kneecap the splint and first four bandages are the same as used for fractures of the lower extremity. Apply bandages above and below the knee as follows: Place the center of 5th cravat bandage just above the kneecap; bring the ends around the leg and splint, cross them under the splint, and bring the ends over the leg above the kneecap, but do not tie. Place the center of 6th cravat bandage just below the kneecap, pass the ends around the leg and splint, then under the splint, bring the ends over the thigh above the kneecap, and tie over 5th bandage. Pull the ends of 5th bandage tight, and tie below the kneecap. After the bandages at the knee are placed, tie the ankle bandage to complete the dressing (fig. 47, *B*).

The proper support for a fracture of the kneecap is made on top of the leg, 1 hand above and 1 hand below the kneecap.

FRACTURE OF LEG

Treatment

When the leg is fractured, the splint for fractures of thigh, knee, or ankle, described above, is used. Where the fracture is close to the knee or ankle an additional bandage, if needed, may be placed between the knee and ankle (fig. 47, *C*).

For a compound fracture of the lower extremity, apply a tourniquet at the thigh pressure point, unless the wound is above that pressure point, in which case apply the tourniquet to the groin pressure point, and dress the wound before applying the splint.

FRACTURE OR CRUSHING OF BONES OF FOOT OR TOES

Such fractures are caused by direct or indirect violence. The symptoms are pain, swelling, and deformity.

Treatment

With two cravat bandages, apply a well-padded splint about 4 inches wide, $\frac{1}{2}$ inch thick, and long enough to reach $\frac{1}{2}$ inch beyond the heel to $\frac{1}{2}$ inch beyond the great toe. Start the center of 1st bandage around the ankle from the back just above the heel. Cross over the arch, carry under the foot and splint, bring up around the heel, cross, and tie in the front. Start the center of 2d cravat bandage on top of the toes, carry the ends around foot and splint several times, and tie on top of the foot (fig. 48).

If there is a compound fracture, apply a tourniquet at the thigh pressure point, and dress the wound before applying splint.

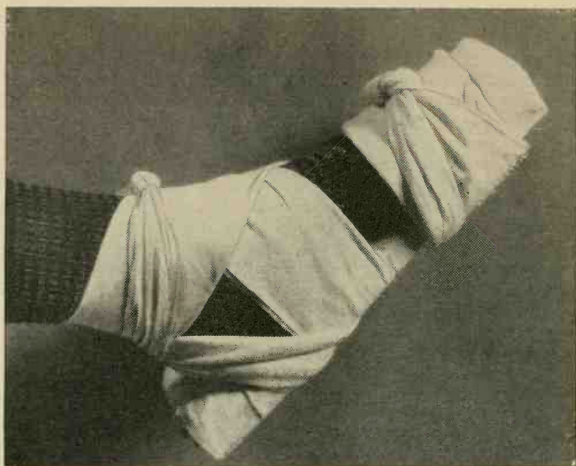


FIGURE 48.—Dressing for Fracture or Crushing of Bone of Foot or Toes.

DISLOCATIONS

Where two or more bones come together and there is no bony union between them, they form a joint. The several bones forming a joint are held in place by bands of strong, fibrous tissues known as ligaments. There are three varieties of joints: Immoveable joints, joints with limited motion, and freely movable joints. In first aid, we are concerned more particularly with the principal free movable joints—the lower jaw, the shoulder, the elbow, the wrist, the fingers, the hips, the knee, the ankle, and the toes. These are the joints most commonly dislocated.

A dislocation is the slipping out of normal position of one or more of the bones forming a joint. The ligaments holding the bones in proper position are stretched and sometimes torn loose. Dislocations result from force applied at or near the joints, from sudden muscular contractions, from twisting strains on joint ligaments, or from falls where the force of landing is transferred to a joint.

The general symptoms of dislocations are as follows:

Rigidity and Loss of Function

The parts forming the joint are held stiff and cannot be moved.

Deformity

The parts assume an unnatural shape and when compared with the normal joint of the opposite side of the body are misshapen. Dislocated extremities may be shorter or longer than normal.

Pain

Pain usually is severe in the region of the joint.

Swelling

Swelling usually is present about the joint.

Treatment

In first aid no attempt should be made to reduce dislocations, except dislocations of the lower jaw, fingers, and toes.

Where medical aid is readily available, do not attempt reduction of even these dislocations. Care for all other dislocations by applying dressings and splints so that the parts are immobilized in the line of deformity in which they are found, and obtain medical treatment. Support dislocations, except those of the lower jaw, fingers, and toes. As shock frequently is present in dislocations, treat for it.

The reduction of dislocations requires skill in manipulating the parts so as not to damage further the joint ligaments and the numerous blood vessels and nerves found close to joints. Only a physician should reduce dislocations, except those mentioned above.

DISLOCATION OF LOWER JAW

A dislocated jaw is painful. The mouth is open, the jaw is rigid and cannot be closed, and there is difficulty in talking.

Treatment

To reduce this dislocation, first wrap both thumbs in several layers of cloth, so that they will not be liable to injury. Then place the thumbs in the injured person's mouth, resting them on his lower teeth well back on each side, while the fingers seize the lower jaw outside. Press first downward, then backward. As soon as the jaw starts into place, slip the thumbs off the teeth to the inside of the cheeks, so that they will not be caught between the teeth when the jaw springs into place. Place the center of a cravat bandage over the front of the chin, and tie it at the back of the head, leaving the ends long. Have the patient open his mouth, and place a bandage compress, pencil, or like object between the teeth to prevent the next bandage from being placed too tightly. Take another cravat bandage, placing its center under the patient's chin, and bring the ends to the center of the top of the head and tie, leaving the ends long. Bring the ends of both cravats together, and tie them separately. Now remove the wedging object from between the patient's teeth (fig. 39, p. 89). If difficulty is experienced in reducing a dislocated jaw, do not make repeated attempts to reduce the dislocation. Apply no dressing, but have the patient consult a doctor immediately.

DISLOCATION OF SHOULDER

The shoulder joint usually is dislocated by falls or blows on the shoulder or by falls on the hand or elbow.

With this dislocation the arm is held rigid, the elbow stands off 1 or 2 inches from the body, the shoulder appears flat, and there is a marked depression beneath the point of the shoulder. In addition, there are pain and swelling at the seat of the injury. By placing the fingers in the armpit, the head of the bone may be felt in an abnormal position compared to the uninjured side. The injured man will be unable to bring the elbow of the injured side in contact with the chest when the palm of the hand of the injured side is placed near the top of the opposite shoulder.

Treatment

While the arm is being supported, place a wedge-shaped pad about 4 inches wide and 1 to 3 inches thick beneath the arm, extending from the armpit to the elbow. Place the center of a cravat bandage on the outside of the arm just above the elbow. Carry one end across the chest and the other end across the back, and tie on the opposite side of the chest over a pad (fig. 49, A). Place the arm in a triangular bandage sling.

DISLOCATION OF ELBOW

Dislocation occurs at the elbow joint as a result of a direct force or blow at the joint and also is caused occasionally by a fall on the hand. It usually can be recognized by deformity at the joint, great pain, and inability to bend the limb at the joint.

Treatment

While supporting dislocation prepare a splint—straight, L-shaped, or a modification of the latter, depending on the position of the limb—long enough to reach from 1 inch below the armpit to 1 inch beyond the tip of the middle finger. Pad to conform to the deformity, and place on the inside of the limb.

To dress with a straight splint, use four cravat bandages, supporting the dislocation while applying the dressing. Place the center of the 1st cravat bandage on the outside of the arm at the upper end of the splint, cross on the inside of the arm over the splint, pass the ends one or more times around the arm and splint, and tie on the outside. Place the center of 2d cravat bandage on the arm just above the elbow, and apply in a similar manner. Place the center of 3d cravat bandage on the forearm just below the elbow, and apply in a similar manner. Place the center of 4th cravat bandage on the back of the wrist, passing the ends around and crossing on the splint under the wrist, bring one end up around the

little-finger side, and cross over the back of the hand and down between the forefinger and thumb. Pass the other end up over the thumb, cross it over the back of the hand down around the little-finger side, then cross both ends on the splint and tie on the top of the hand (fig. 49, *B*). In sending the patient to a physician, tie 5th cravat bandage around the splint, limb, and body to prevent movement.



FIGURE 49.—*A*, Dressing for Dislocation of Shoulder (Triangular Sling Not Shown); *B*, Dressing for Dislocation of Elbow, Using Straight Splint.

To dress with an L-shaped splint, have the upper part of the splint 4 inches wide and $\frac{1}{4}$ inch thick and reach from 1 inch below the armpit to the point of the elbow and the other part reach from the point of the elbow to 1 inch beyond the middle finger. Join the two parts securely, forming the angle of deformity of the arm. Support the dislocation, and pad it well to conform to the deformity of the arm. Apply a splint with four narrow cravat bandages, as described under straight splint. This dressing is similar to that for a fractured forearm (fig. 42, A, p. 93). Place the forearm in a cravat-bandage sling.

DISLOCATION OF WRIST

Dislocation of the wrist usually occurs where the hand is extended to break the force of a fall. It is difficult, however, to distinguish between a dislocated and a fractured wrist.

Treatment

To be on the safe side, treat a suspected dislocated wrist the same as a fractured one (fig. 42, A, p. 93).

DISLOCATION OF FINGER

The usual symptoms of a dislocated finger are shortening, deformity of the joint, pain, swelling, and inability to bend the finger at the dislocation.

Treatment

To treat a dislocated finger, have the hand with the back upward. Grasp the finger just above the dislocated joint, with one hand and just below the joint with the other hand so that the extension is made only at the dislocated joint. Pull straight away from the hand, and the bone usually will slip into place. When traction is made on more than the injured joint, a secondary dislocation may occur. Do not attempt to reduce a dislocated finger if there is an open wound near the joint. Dress the wound, and send the patient to a physician.

DISLOCATION OF HIP

Dislocation of the hip usually results from falling onto the foot or knee, or may be caused by a direct blow when the thigh is at an angle with the spine. There are several varieties of dislocation, described according to the direction taken by the head of the thigh bone, but for all practical purposes they may be divided into forward and backward dislocations. A backward dislocation is by far the most common. In either type of dislocation the limb is held rigid, and the pain is marked. In a forward dislocation the thigh is somewhat flexed and held outward, the foot being

also turned out. The limb may be lengthened or shortened. In a backward dislocation the foot is turned inward, and the thigh is drawn toward or across the opposite leg. Shortening of the limb is also marked.

Treatment

Place the injured person on a board about 12 inches wide, 7 feet long, and about $1\frac{1}{2}$ inches thick. If such a board is not available, use a framework similar to that employed in dressing a broken neck or back. Raise the patient only high enough to place him on the splint. Before the patient is placed on the board or back splint, test it to be sure that it is strong enough to bear his weight. When lifting the patient, support the injured limb to avoid further pain and damage to the hip joint. Support is necessary until bandages and a splint are applied. Pad well with blankets, clothing, etc. Make a pad of clothing, blankets, or brattice cloth large enough to support the limb in the line of deformity. Place a small pad between the feet. Use six cravat bandages, as follows: Pass 1st cravat bandage around the board and the upper part of the chest, and tie the ends of the bandage on the injured side near the board. Pass 2d cravat bandage around the board and lower part of the chest, and tie the end of the bandage on the injured side near the board. Pass 3d cravat bandage around the board and the body at the hips, tying the ends as described above. Pass 4th cravat bandage around the board and the thigh just above the knees, and tie it on the injured side near the board. Pass 5th cravat bandage around the ankles and the board, and tie it near the board on the injured side. Place the center of 6th cravat bandage over the insteps, cross the ends under the soles of the feet, and bring them back to the insteps, tying loosely (fig. 50). The board or back splint may be used as a stretcher for transportation.

If the patient is unconscious, pass a cravat bandage around the head and the board, tie it, and tie the forearms folded across the chest (fig. 7, p. 20).

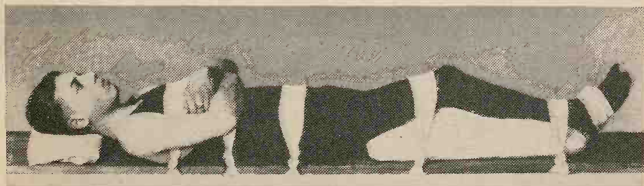


FIGURE 50.—Dressing for Dislocation of Hip.

DISLOCATION OF KNEE OR KNEECAP

Dislocation of the knee or the kneecap results from direct force applied at the knee or from a fall on the knee. There are signs of deformity, great pain, and inability to use the knee.

Treatment

While supporting dislocation, apply a splint as for fracture of thigh, padding to conform to the deformity (fig. 47, A, p. 102).

DISLOCATION OF ANKLE

Dislocation of the ankle may show several types of deformity. Bones may or may not be broken. There is a marked deformity at the joint. As a rule, swelling is rapid and marked. Usually the extent of the injury can be determined only by X-ray.

Treatment

While supporting the dislocation, apply a splint as for fracture of the thigh, padding to conform to deformity (fig. 47, A, p. 102).

DISLOCATION OF TOE

The usual symptoms of a dislocated toe are shortening, pain, deformity at the joint, and inability to bend the toe at the dislocated joint.

Treatment

Grasp the toe in one hand below the dislocated joint, grasp above the joint with the other hand, and pull until the joint slips into normal position. Only the dislocated joint should be between the first-aid man's hands. As in the case of the finger, when traction is made on more than the injured joint, a secondary dislocation may occur. Do not attempt to reduce the dislocation if there is an open wound near the joint. Dress the wound, and send the patient to a physician.

Chapter XI. HANDLING AND TRANSPORTATION OF INJURED

After receiving first-aid care a seriously injured person often requires transportation to a hospital, to a physician's office, or to his home. It is the responsibility of the first-aid man to see that the patient is transported in such a manner as to prevent further injury and is subjected to no unnecessary pain or discomfort. No matter how expert the first-aid care that has been given, improper handling and careless transportation often add to the severity of the original injuries, increase shock, and frequently endanger life.

Never move a patient until a thorough examination has been made and all injuries are protected by proper dressings. Seriously injured patients should be moved only in lying position. If means for proper transportation of an injured person are not immediately at hand, continue care of the patient to conserve his strength until adequate means of transportation can be procured.

Various carries can be used in emergencies, but the stretcher is the preferred transportation method. Carrying in the arms, carrying astride the back, and the two-man carry should be used only when it is positively known that no injury will be aggravated by such handling of the patient.

THREE-MAN LIFT AND CARRY

Knowledge of this lift is very important, as an injured person can be moved or carried thus with a minimum of further injury or discomfort. It is used where an injured person is to be carried a short distance, where he must be transported through narrow passageways, or where a stretcher is not available.

The lift is used also when an injured person is being placed on or removed from a stretcher.

Three persons are required for this lift, and a fourth is desirable. Proper lifting must be done by commands of a captain or one of the bearers, usually the one at the patient's head.



FIGURE 51.—Three-Man Carry: Preparing to Lift Patient.

"Prepare to lift—patient." Each of the three men kneels on the knee nearest the patient's feet, one opposite the patient's shoulder, another opposite his hips, and the third opposite his knees. Unless the nature of the patient's injuries makes it undesirable, the bearers kneel by his uninjured or least-injured side. The bearer at the feet places his hands under the patient's knees and ankles, the bearer in the center places his hands under the patient's thighs and small of back, and the bearer at the head places his hands under the patient's neck and shoulders (fig. 51). At the command, "Lift—patient," they slowly raise the patient and support him on their knees (fig. 52). At the command, "Prepare to rise with—patient," the bearers slowly turn the patient onto his side so that he rests in the bend of their elbows and is held closely to their chests. When the command, "Rise with—patient," is given, all rise slowly (fig. 53). The bearers can now, when commanded, step off in any direction with the patient. The bearers sidestep when so commanded, "Sidestep left (or right)—march." The bearers step off with the foot corresponding to the direction of command, bringing the heels together at each second step. The steps should be short and made slowly.

STRETCHERS

The ordinary stretcher, known as the Army stretcher, consists of two long poles with a bed, usually made of canvas, between them and crosspieces to keep the long poles apart and thus stretch the canvas. The poles are long enough to afford hand holds for the bearers at each end of the stretcher (fig. 54, A).



FIGURE 52.—Three-Man Carry: Patient Resting on Bearer's Knees.



FIGURE 53.—Three-Man Carry: Patient in Position to Carry.

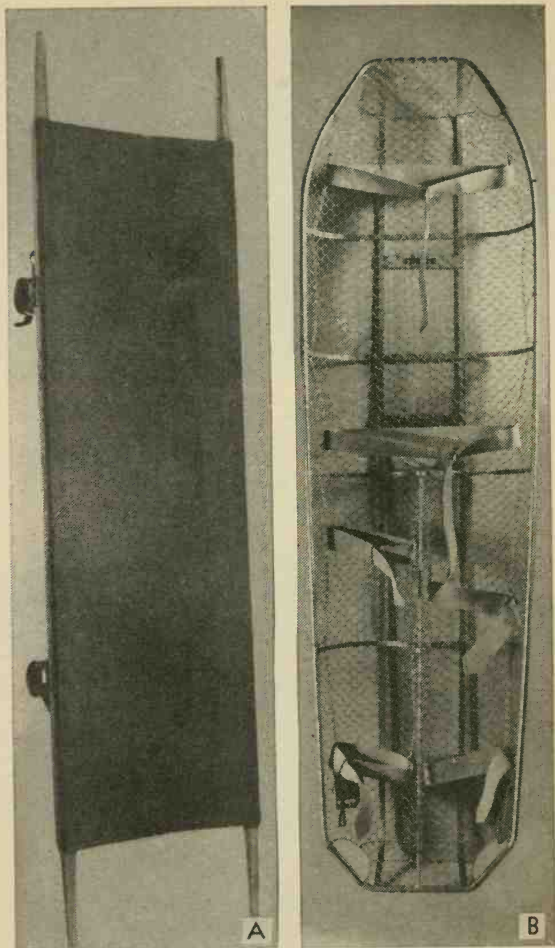


FIGURE 54.—*A*, Army Stretcher; *B*, Stokes Navy Stretcher.

The Stokes Navy stretcher is a woven-wire basket made to conform to the human body. The patient, after having been strapped to the basket, may be placed in a vertical position and carried on a mine cage or skip. This type of stretcher is used almost exclusively in metal mines or in coal mines where the coal bed has a steep pitch (fig. 54, B).

IMPROVISED STRETCHERS

A very satisfactory stretcher may be improvised with a blanket, brattice cloth of similar size, a robe, or a strong sheet and two poles or pieces of pipe each 7 to 8 feet long. Place one pole or pipe about 1 foot from the center of the unfolded blanket. Fold the short side of the blanket over the pole toward the other side. Place the second pole on the two thicknesses of blanket about 2 feet from the first pole and parallel to it (fig. 55, A). Fold the remaining side of the blanket over the second pole toward the first pole. When the injured person is placed on the blanket, the weight of the body secures the folds.

Bags or sacks may be used for stretcher beds. Rip bottoms of the bags or sacks so that the poles may be passed through them; use enough to give the length of bed required. A stretcher may also be made from 3 or 4 coats or jackets. Turn them inside out, and pass two poles through the sleeves. Then turn down the flaps around the poles, and button them underneath.

Test any stretcher before placing an injured person upon it.

BUREAU OF MINES UTILITY SPLINT STRETCHER

The Bureau of Mines utility splint stretcher is a modification of the Bureau's broken-back splint. It is permanently assembled and has pipe runners to give added strength and afford handholds (fig. 55, B).

It is constructed of white pinewood, dressed and free from knots or other defects. The two long boards are 78 inches by 6 inches by 1 inch. The cross members are 21 by 4 by 1½ inches.

The long boards are spaced 2 inches apart. The cross member at the head end is set back 15 inches from the ends of the long boards and permanently fastened to them by wood screws. The cross member at the feet end is set back 2 inches from the ends of the long boards and permanently fastened by wood screws. The center cross member is not attached to the long boards but, as will be explained later, is movable up and down the long boards by its attachment to the pipe runners.

The pipe runners are ¾-inch wrought-iron conduit pipe 96½ inches long, threaded and capped at the ends.

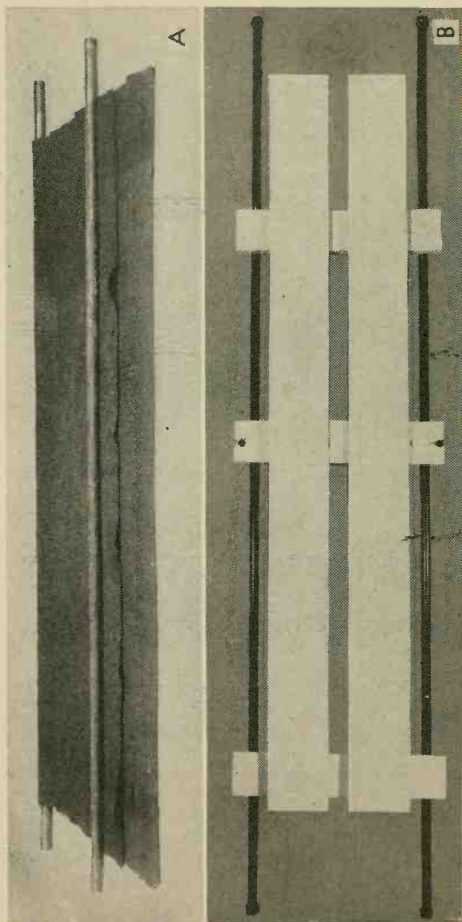


FIGURE 55.—A, Improvised Blanket Stretcher, Partly Folded; B, Bureau of Mines Utility Splint Stretcher

The pipe runners are attached to the under surface of the cross members where they project beyond the long boards. At the upper and lower cross members the pipe runners are anchored by wrought-iron straps around the pipe and bolted through the cross members by $\frac{1}{4}$ -inch carriage bolts. The center cross member is attached to the pipes by a bronze strap, the inner bolt being permanent and the outer having a wing nut. The bronze strap is so sprung that, when the wing nut is loosened, it tends to disengage the pipe, making the center cross member adjustable up and down the long boards.

The pipe runners are attached to the cross members, so at the head end they extend $7\frac{1}{2}$ inches beyond the splint and at the feet end 11 inches beyond the splint. This difference in the projection of the pipes at the two ends is necessary for carrying.

A splint stretcher weighs approximately 40 pounds. It is very sturdy and will stand continued hard usage. It can be constructed inexpensively in any plant or mine carpenter shop. It is believed that its sturdiness and low cost will permit placement about plants and mines, to be available when needed.

Among the injuries for which a splint stretcher can be used are dislocated hip, dislocated knee, fracture of neck, fracture of back, fracture of pelvis, and all fractures of the lower extremities.

STRETCHER TRANSPORTATION

Always test a stretcher before a patient is placed on it. To do so, place an uninjured man, weighing as much or more than the patient, on the stretcher, and lift it. Take great care in placing an injured person on a stretcher; otherwise he will suffer unnecessary pain. The bearers should work together on command of the captain or of the man in charge. Whenever possible, a mine car should be used in transporting an injured person out of a mine, the stretcher being either fastened or held in the car to prevent unnecessary jarring. The car should be taken out alone and not with a loaded trip, and such a car should always have the right-of-way. No matter how well-trained the men who have charge of the injured, it is impossible to carry an injured man along the roadbed in a mine without irregular stepping and jolting. Some companies have met this problem of transporting injured persons out of mines efficiently by providing special ambulance tramcars. It is hoped that this method may soon become universal. In handling an injured man, with or without a stretcher, the bearers should move together and as gently and steadily as possible. In some instances where a patient is to be transported by stretcher, it is advisable to fold his arms across his chest and tie them together, as described on page 20 (fig. 7). When necessary, the feet also may be tied together during transportation.

The same lift is used for loading an injured person onto a stretcher, as described under **Three-man Lift**, page 111; however, the injured person is only raised and supported on the knees of the three lifting men and then placed on the stretcher.

Although 3 men can lift and place an injured person on a stretcher, it is desirable to have a fourth man, whose position should be at the hips, on the opposite side of the other 3 lifters. He places his hands under the thighs and small of the back and assists the other three in raising the patient to the knees of the lifters. He then places the stretcher under the injured person.

In injuries to the neck, back, pelvis, or hip, the patient is lifted just high enough to slide the body splint or splint stretcher under him and not to the knees of the kneeling men.

STRETCHER DRILL

The stretcher squad consists of 5 men, 1 of whom will be the captain. The captain should direct and supervise all work of the first-aid men. After determining the various injuries and their severity, the captain should assign every man his duty and himself should assist in the work. His words of command, as outlined below, should be obeyed promptly.

The stretcher drill described below is recommended for use in first-aid contests (figs. 56-63).

The captain should give all commands in a military manner; that is, he should give first a preparatory command to place each man in readiness and follow this command after a definite interval of 1 or 2 seconds by the command of execution. With this method, the movements can easily be made in unison and consequently more satisfactorily and efficiently. The dash (—) in the command as given represents the interval between the preparatory and the final command.

CAPTAIN. "Fall in."

The four men fall in line, standing side by side, each with head erect, hands at sides, heels together, and eyes straight ahead. When each man stands at attention in this manner the squad makes a fine appearance.

CAPTAIN. "Count off."

The man at the right of the squad (looking toward the patient) calls, "One," and the remainder of the squad follow in order, counting "Two," "Three," "Four."

CAPTAIN. "Procure stretcher—march."

At the command, "March," No. 3 steps forward and proceeds to the stretcher by the shortest route, picks it up, places it over his right shoulder, and returns to his place in line (fig. 56).

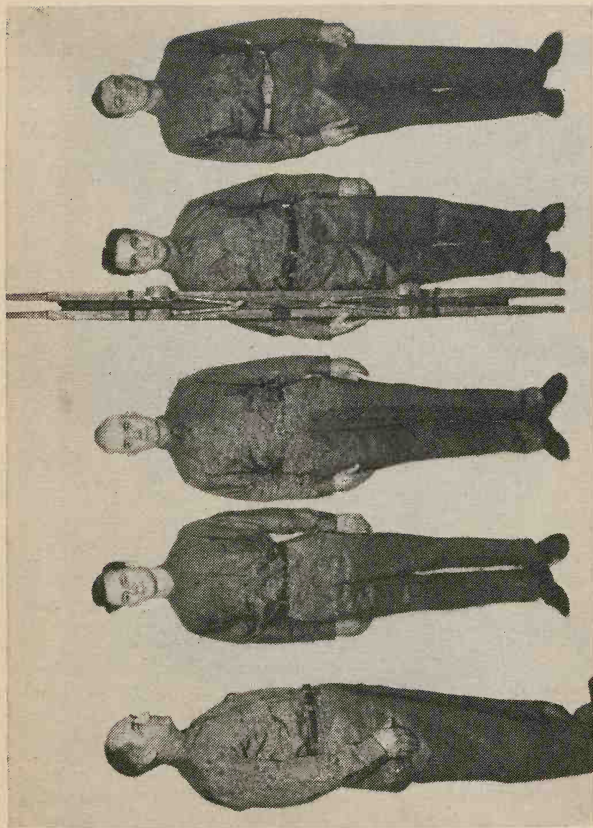


FIGURE 56.—Crew in Line for Stretcher Drill, No. 3 Having Obtained Stretcher.

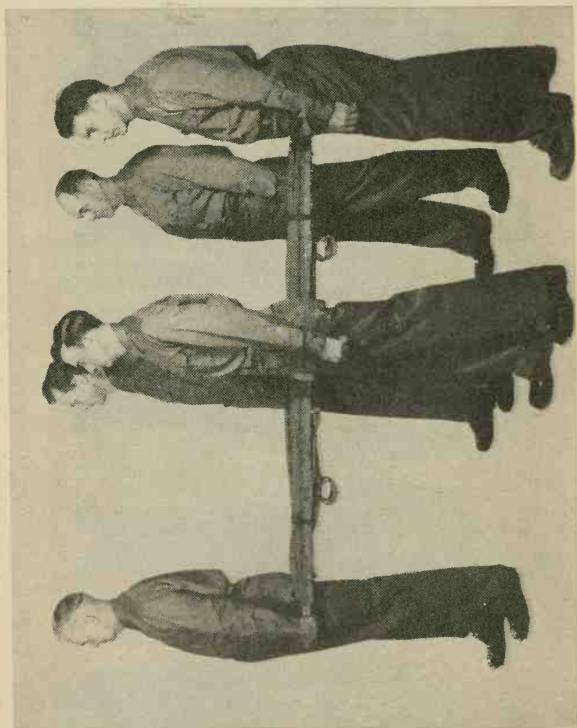


FIGURE 57.—Stretcher Drill: Carrying Stretcher.

CAPTAIN. "Carry stretcher—march."

At the command "March," No. 3 tilts the stretcher on his shoulder and, holding one end, allows the other end to fall slowly forward. At the same time, No. 2 takes two long paces to the front, and as the stretcher drops forward he catches the handles at the free end with his left hand. No. 1 steps to the middle of the right side of the stretcher, and No. 4 steps to the middle of the left side (fig. 57).

CAPTAIN. "To patient, forward—march."

After reaching the patient, Nos. 2 and 3 open the stretcher and fix the braces.

CAPTAIN. "Test stretcher."

Nos. 2 and 3 grasp the stretcher by the handles facing each other; and No. 1 or No. 4, whoever is the heavier, takes his place on the stretcher and is raised 3 feet from the ground to test it.

CAPTAIN. "Post to patient's right (or left)—march."

No. 3 takes his position on the side indicated opposite the patient's head, No. 1 opposite the patient's hips, No. 2 opposite the patient's ankles, and No. 4 on the other side of the patient opposite the hips. In placing the patient on the stretcher, the lift is made with 3 men on the uninjured or least-injured side, unless the nature of the patient's injuries makes it advisable to have 3 men on the injured or more severely injured side.

CAPTAIN. "Prepare to lift—patient."

Each of the four men kneels on the knee nearest the patient's feet—No. 2 opposite the patient's knees, No. 3 opposite the patient's shoulders, and Nos. 1 and 4 opposite the patient's hips on their respective sides. No. 3 places his hands under the patient's neck and shoulders, No. 2 places his hands under the patient's knees and ankles, while Nos. 1 and 4 place their hands under the patient's pelvis and the small of his back (fig. 58).

CAPTAIN. "Lift—patient."

The patient is slowly raised, taking care to keep his body level, and is supported on the knees of the three men, and the other man places the stretcher under the patient (fig. 59). In injuries to the neck, back, pelvis, or hip, the patient is lifted just high enough for the captain to slide the body splint or splint stretcher under him, and not to the knees of the kneeling men.

CAPTAIN. "Prepare to lower—patient."

The man who has placed the stretcher kneels and places his hands in position to support the patient.

CAPTAIN.—"Lower patient."

The patient is gently lowered to the stretcher, as shown in figure 60.



FIGURE 58.—Stretcher Drill: Preparing to Lift Patient.



FIGURE 59.—Stretcher Drill: Patient Resting on Bearer's Knees; Stretcher Placed in Position.

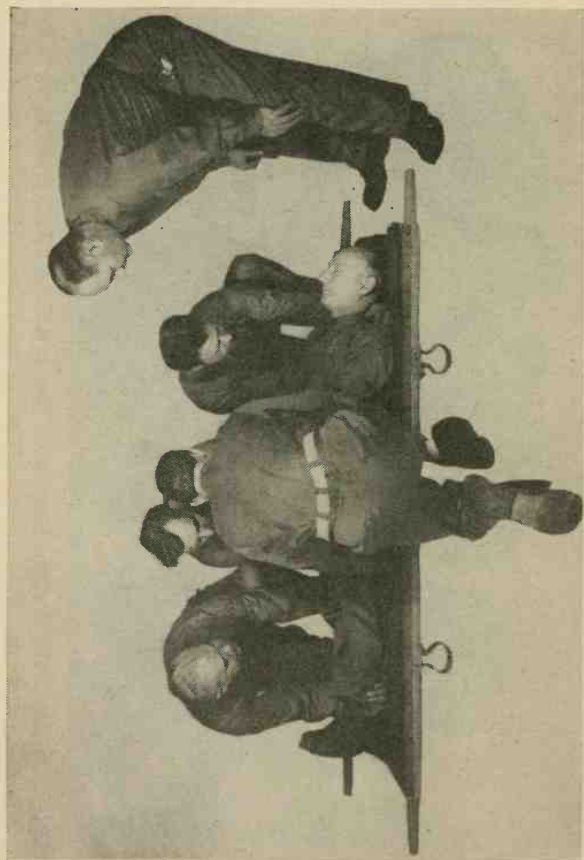


FIGURE 60.—Stretcher Drill: Lowering Patient.

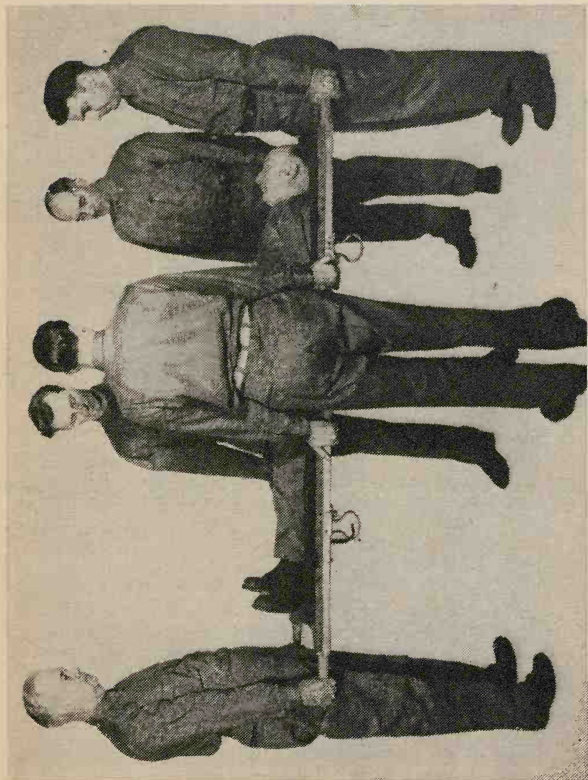


FIGURE 61.—Stretcher Drill: Lifting Stretcher.

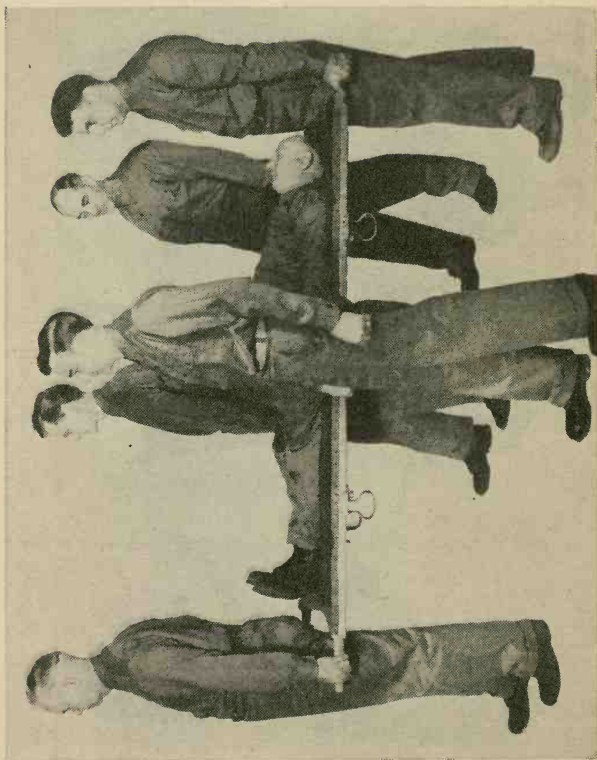


FIGURE 62.—Stretcher Drill: Carrying Patient.

CAPTAIN. "Post to carry stretcher—march."

No. 3 takes his place at the rear end of the stretcher. The patient is carried on the stretcher feet first, the end nearest his feet being the front end and nearest his head the rear; No. 2 takes his position at the front end, and Nos. 1 and 4 stand on either side. Nos. 2 and 3 face each other, and Nos. 1 and 4 face each other.

CAPTAIN. "Prepare to lift—stretcher."

All stoop and grasp the stretcher, Nos. 2 and 3 by the handles and Nos. 1 and 4 at the sides.

CAPTAIN. "Lift—stretcher."

The stretcher is gently and slowly raised. Nos. 1 and 4 shift one hand toward the front of the stretcher and support this end, while No. 2 turns to the marching position. If the patient's head is bleeding severely and he must be carried up a steep grade on a stretcher, his head should be carried first, with No. 3 bearer leading (figs. 61 and 62).

CAPTAIN. "Forward—march."

Nos. 1, 2, and 4 step off with the left foot, whereas No. 3 steps off with his right foot. This procedure prevents the stretcher from swaying.

In marching, when necessary to turn:

CAPTAIN. "Squad right (or left)—march."

In marching, when it is necessary to turn completely around or when an ambulance is approached from the rear:

CAPTAIN. "Squad right about (or left about)—march."

The squad makes a complete half turn about (180°) to the right or left.

CAPTAIN. "Squad—halt."

At the command "Halt" each man takes an additional step forward and brings the foot in the rear up to a heel-to-heel position with the foot that is forward.

CAPTAIN. "Prepare to lower—stretcher."

Nos. 1 and 4 shift one hand toward the front of the stretcher and support this end, while No. 2 turns around, facing No. 3. Nos. 1 and 4 take position facing each other.

CAPTAIN. "Lower—stretcher."

"Prepare to cross—obstacle."

Nos. 1 and 4 grasp the handles with their free hands, relieving No. 2, so that he can cross the obstacle.

CAPTAIN. "Cross obstacle—march."

Nos. 1, 4, and 3 then advance the stretcher over the obstacle to a point where No. 2, who has crossed to the other side, can grasp and support the handles at the front end. Nos. 1 and 4 then cross the obstacle and again obtain side holds on the stretcher, relieving No. 3 and carrying the stretcher forward with the assistance of No. 2. No. 3 then crosses the obstacle and takes his normal position.

Because of low or narrow places and numerous obstructions a patient sometimes cannot be carried on a stretcher

within a mine or other low or narrow places according to the directions outlined above; therefore, the following method has been adopted:

To transport an injured person on an Army-type stretcher in a mine the stretcher bearers should be in a position to see where they step. For carrying a patient underground, each of the four stretcher bearers should take hold of a handle of the stretcher. The free hand may be used for carrying a light or for support along the side of passageways. The captain should precede and select the route, Nos. 2 and 4 taking lead handles and Nos. 1 and 3 the rear handles of the stretcher.

Figure 63 is a diagram of standardized stretcher drill.

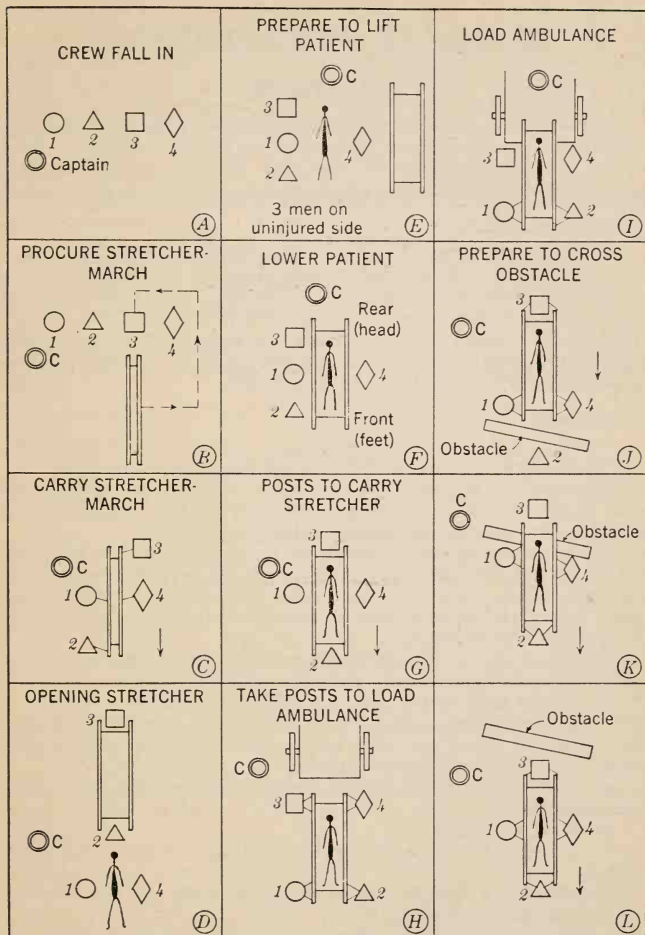


FIGURE 63.—Diagram of Stretcher Drill.

Chapter XII. MISCELLANEOUS

SUNSTROKE

Sunstroke is a sudden attack of illness from prolonged exposure to the direct rays of the sun or to other high temperatures without exposure to the sun. Those engaged in hard labor in confined quarters are particularly likely to be affected.

Symptoms

The attack is sudden, and the patient becomes unconscious rapidly. Unconsciousness may be preceded by intense headache and dizziness. The face is red and flushed. The skin is hot and dry, with no perspiration. The pulse is strong and rapid or even may be bounding in character. Breathing is labored and of a snoring type. The pupils of the eyes are enlarged but of equal size.

Treatment

Because the body temperature is excessively high, treatment centers around reducing it as quickly as possible.

Remove the patient to a cool place, and lay him down with the **head raised** by placing a pad under the shoulders and head to reduce the flow of blood to the brain.

Take off as much clothing as necessary, and apply cold applications to the body and head. The patient may be wrapped in a sheet kept wet with cold water or placed in a cold bath. If ice is available, rub his body with it, and place an icecap on his head.

Rubbing the patient's limbs toward the heart aids circulation and is important. Rub through wet sheet.

Continue cold applications until consciousness returns or until body temperature returns to normal. Watch for signs of physical shock as the temperature drops. If physical shock occurs, treat accordingly.

When the patient is conscious, give him all the cool water he desires.

Give no stimulant.

If the skin becomes hot and dry again, renew cold applications.

Sunstroke is a very dangerous condition; obtain medical care as soon as possible.

HEAT EXHAUSTION

Heat exhaustion is collapse from the effect of heat—from the sun or any other source. It occurs more frequently when the humidity is high. Heat exhaustion is a serious condition, and proper treatment should be given at once.

Symptoms

The patient is seldom unconscious but may complain of feeling very weak. His face is pale and anxious looking and covered with cold perspiration. Frequently he vomits. He may complain of feeling chilly. His pulse is rapid and weak, and his breathing is shallow, with little chest expansion.

Treatment

The treatment for heat exhaustion is the same as that for physical shock.

The patient should be lying down with the head low.

Cleanse his mouth.

Wrap his body in coverings.

Apply hot applications.

Use stimulants.

Rub the extremities.

Give salt (a good-size pinch or a salt tablet to each glass of water).

Obtain the services of a physician.

HEAT CRAMPS

Symptoms

Heat cramps are painful spasms of muscles, especially those of the abdomen and limbs, after prolonged exposure to high temperatures while engaged in strenuous labor. The spasmodic cramps experienced may be simply a slight cramp in the abdomen or muscles of an extremity or so severe as to cause convulsions. Attacks may be brief or may last 12 to 24 hours; after being relieved, the spasms may be renewed by exposure to a cold draft or exertion.

Nature attempts to relieve a person working in high temperatures by sweating and evaporation of the sweat. Profuse sweating not only removes moisture from the body but a considerable amount of the salt content of the body fluids as well. Loss of the body's salt content from the body fluids excites irritation of the muscles, causing the spasmodic cramps.

In first aid, prevention of heat cramps is much more important than treatment, which is mainly medical. Men at hard work in high temperatures should drink adequate amounts of cool water (10 to 15 glasses a day) to replace the fluid lost in perspiration and at the same time replace salt also lost by adding to each glass of water a good-size pinch of salt or a salt tablet, such as is supplied by a dispensing cabinet near drinking fountains in many large plants. They should limit their diet to light, easily digested food, avoid fatty food, and avoid constipation. Working clothes should be light and porous to promote evaporation of perspiration.

Treatment

The treatment for mild heat cramps is increased salt intake, warm baths, and rest. If the cramps are severe and persistent, medical care is necessary.

FROSTBITE

Frostbite results from exposure to severe cold. The nose, cheeks, ears, toes, and fingers are the parts most frequently frostbitten.

Symptoms

Frostbite is more likely to occur when a high wind is blowing, which takes heat from the body rapidly. Usually frostbite is not associated with pain but rather with a feeling of intense coldness and numbness. The victim may not be aware of frostbite of the cheeks, ears, or nose until someone tells him, or of frostbite of hands or feet until he removes his gloves or shoes. The frostbitten area is dead white.

Treatment

Do not rub the part frostbitten.

Do not expose the part to high temperatures immediately.

Until the victim can be brought indoors, the frozen part should be covered with woolen cloth or clothing and the victim himself should be made warm with extra clothing or blankets, if possible. As soon as possible, he should be brought into a warm room. He should be given a warm drink.

The frozen part should be handled with great care in order to avoid injury to it. If it is still cold and numb, it should be rewarmed as rapidly as possible by immersing it momentarily in lukewarm, but **not hot**, water or by gently wrapping it in warm blankets. Hot-water bottles or heat lamps should **not** be applied, nor should the frostbitten part be placed near a hot stove. Excessive heat may increase the damage. Once the frostbitten part is rewarmed, the patient should simply be encouraged to exercise injured toes or fingers. Blisters should not be disturbed.

All frostbites of the second and third degree should have medical care as promptly as possible.

FREEZING

Symptoms

When the entire body reacts to exposure to severe cold the individual becomes numb, exertion is difficult, his eyesight fails, he totters and falls, irresistible drowsiness overtakes him, and he becomes unconscious.

Treatment

Procure medical attention as promptly as possible.

If breathing has stopped, begin artificial respiration. Bring

the victim into a warm room as quickly as you can. He should be rewarmed as rapidly as possible, either by placing him in a tub of warm, but not hot, water or by wrapping him in warm blankets. When he reacts, he should be given a hot drink and kept in a warm bed.

Continue efforts to revive a frozen person for several hours, as persons apparently dead have been restored to life after many hours of treatment.

APOPLEXY

Apoplexy, cerebral hemorrhage, or stroke is spontaneous rupture of a blood vessel within the skull, causing a hemorrhage into the brain tissues. It usually occurs in elderly persons.

Besides spontaneous rupture of a blood vessel within the brain, blows to the head may cause cerebral hemorrhage. In all head injuries, symptoms of cerebral hemorrhage should be looked for, and if present the treatment for apoplexy should be administered.

The patient becomes unconscious gradually or suddenly. Unconsciousness may be preceded by a sense of pressure and pain within the head. When the hemorrhage occurs, blood from the ruptured blood vessel accumulates in the part of the brain near the rupture; as the accumulation increases, there is pressure on the substance matter of the brain, usually leading to paralysis of the part of the body controlled by the section of the brain where the pressure is exerted.

Symptoms

The patient usually is unconscious. The face is flushed and warm but sometimes may appear ashen gray. The pulse at first is slow and strong but later becomes rapid and weak. Respiration is slow and snoring in type, the lips and cheeks puffing out at each expiration. **The pupils of the eyes are unequal in size**, and often one eyelid droops. Frequently the mouth is drawn to one side, and if the patient tries to talk he mumbles out of one side of the mouth. Usually only one side of the body is paralyzed.

Treatment

Have the patient lying down with the head well-raised by a pillow or good-size pad under the shoulders and head.

Allow plenty of fresh air, but keep the patient warm with covers.

Apply cold applications or an ice bag to the head.

Give no stimulants.

Keep the patient absolutely quiet, and do not move him unless necessary.

Obtain medical care as soon as possible.

Chapter XIII. POISONS

Many substances are poisonous to the human body and gain entrance into it in several ways. It is not expected that a first-aid man will be able to recognize the symptoms of all the different kinds of poisons or know the treatment required for each; however, he should be able to care for the commoner poisons and to render general first aid to all cases, irrespective of the kind of poison.

The first duty is to send for a physician immediately and then give treatment that will relieve and protect until medical aid arrives.

ENTRANCE OF POISONS INTO BODY

Poisons may enter the body through several channels:

Swallowed, either intentionally or by mistake, after being taken into the mouth.

Inhaled in the form of noxious dusts, gases, fumes, or mists.

Injected within the skin by bites of poisonous snakes, insects, or rabid animals and by hypodermic injections. Bacteria may enter through open wounds.

Contacted by the skin (poisonous plants and certain fungi) or absorbed through the skin (mercury, certain poisonous liquids, and gases).

POISONING BY MOUTH

For the purpose of first aid, the poisons entering the human body by mouth are divided into three general groups, according to their action: Corrosive poisons, irritant poisons, and convulsant poisons.

Always save any receptacle suspected to have contained the poison, and retain samples of any vomited matter. Turn these over to the physician on his arrival, as they may be of material aid in determining the nature of the poisoning.

CORROSIVE POISONS

Corrosive poisons corrode, burn, or eat into the tissues when they come in contact with the mucous membrane of the lips, mouth, throat, gullet, and stomach. Besides the immediate corroding action on the tissues they touch, they excite an inflammatory condition of the deeper tissues and in some instances through absorption exert harmful effects on the entire system. Physical shock frequently is present in cases of corrosive poisoning.

The more common corrosive poisons are the strong acids and the strong alkalies.

Corrosive acids	Corrosive alkalies
Hydrochloric acid.	Potash or caustic potash.
Sulfuric acid.	Soda or caustic soda.
Nitric acid.	Lye.
Oxalic acid.	Unslaked lime.
Carbolic acid.	Strong ammonia water.
Lysol.	

If he is not unconscious and if the act was not intentional, a person who has swallowed a corrosive poison usually will identify it. If the poison container is available it will aid in identifying the type of poison taken.

Symptoms

The lips and mouth are stained and show evidence of searing or burning.

If conscious, the person will complain of severe pain in the mouth, throat, gullet, and stomach. There usually is intense thirst. There may be difficulty in talking and swallowing owing to swelling caused by the poison.

Treatment

Determine, if possible, whether an acid or an alkali has been taken.

Never give an emetic.

For acids, except carbolic acid or Lysol, give limewater, chalk and water, milk of magnesia, or 1 teaspoon of baking soda in lukewarm water. Have the patient drink several glassfuls of any of the above.

For alkalies give a weak acid solution, such as equal parts of vinegar and water or lemon or orange juice and water. Have the patient drink several glasses of any of the above.

For either acids or alkalies dilute the poison, and soothe the corroded tissues by repeated drinks of milk, raw eggs beaten in milk or water, olive oil, salad oil, flour beaten up with water, barley water, or a thin gruel made from the soft cereals.

Watch for physical shock and treat it at once if present.

Carbolic Acid or Lysol Poisoning

The bottle containing the poison may be found and the poison identified.

Symptoms

The odor of carbolic acid or Lysol will be noted on the breath of the patient. He probably will vomit, and the vomited matter will have the characteristic odor of carbolic

acid or Lysol. The general symptoms are those due to corrosive poisons.

Treatment

Wash out the mouth with equal parts of grain alcohol and water.

Permit the patient to have repeated small drinks of whisky or brandy in equal parts with water, or wine undiluted.

In the absence of alcoholic liquors, give the whites of raw eggs beaten up in water, soapsuds, or dilute vinegar in repeated doses of a glass at a time. Do not give milk or oils until the stomach has been completely emptied.

Later give the patient large quantities of salt water, mustard water, or alum water—1 tablespoon to a glass of lukewarm water. Several glasses of any of the above will dilute the poison and promote vomiting.

After the patient has vomited, give epsom or glauher salt or sodium phosphate to aid in eliminating any of the poison that may have entered the circulatory system.

When the stomach has been emptied, milk, gruel, or flaxseed tea may be given to soothe the corroded tissues.

Watch for physical shock, and treat it promptly. Artificial respiration will be required if breathing ceases.

IRRITANT POISONS

The irritant poisons are substances that, when swallowed, set up irritation within the stomach, manifested by distress, nausea, vomiting, and severe pain. With most of the irritant poisons, these symptoms are caused by direct irritation of the membrane lining the stomach, but with others there is a secondary action through absorption.

The more common irritant poisons are mainly the metals or the salts of metals:

Antimony and many of its combinations.

Arsenic and many of its combinations.

All the combinations of copper.

Iodine and many of its combinations.

All the combinations of lead.

All the combinations of mercury.

Phosphorus and many of its combinations.

Silver nitrate.

All the combinations of zinc.

Symptoms

Many irritant poisons do not stain the lips or mouth. Tincture of iodine gives the characteristic iodine stain. Silver nitrate stains the lips, first whitish and later dark to black. Strong salts of mercury and zinc corrode the lips and tongue, which appear white and shriveled. A metallic taste in the mouth is a common symptom in most of the irritant

poisonings. Pain in the stomach, followed by nausea and vomiting, are common to all cases of irritant poisoning. Prostration and physical shock usually are present in the more severe cases.

Treatment

Determine, if possible, the kind of poison taken.

Promote vomiting, and empty the stomach as soon as possible. Give salt water, mustard water, or alum water—1 tablespoon to a glass of lukewarm water. Repeat the above until the patient has vomited several times.

After the stomach has been emptied give the whites of eggs in water or milk (except in **phosphorus poisoning**), barley water, or thin gruel made from the soft cereals.

Watch for physical shock, and treat it if necessary.

Special Treatment for Iodine Poisoning

Give large quantities of starch mixed with water or a thin paste of flour mixed with water before attempting to promote vomiting or even if vomiting has already occurred. Follow with general irritant-poisoning treatment.

Special Treatment for Copper or Mercury Poisoning

Give whites of eggs beaten with water or milk before attempting to promote vomiting or even if vomiting has already occurred. Follow with general irritant-poisoning treatment.

Special Treatment for Phosphorus Poisoning

Do not give any oil or fat, as oil dissolves phosphorus. After stomach has been emptied, give epsom or glauber salts. Follow with general irritant-poisoning treatment.

Special Treatment for Silver Nitrate Poisoning

Give drinks of strong salt water immediately. Follow with general irritant-poisoning treatment.

The irritant metallic poisons discussed above are those that have caused acute poisoning. Many metallic poisons may occur in quantities insufficient to cause acute poisoning but do cause chronic poisoning by accumulation within the system. In the chronic poisonings the symptoms appear gradually, becoming more and more severe and more widely distributed throughout the body.

SYSTEMIC POISONS

The systemic poisons affect the body as a whole through their action on various systems, organs, or tissues. The systemic poisons are divided into two general groups: (1) The depressant poisons, whose general action is that of a narcotic (sleep producing), with progressive lowering of the vital functions of the circulation and respiration; and (2) the

convulsant poisons that produce spasms or convulsions, with rapid paralysis of the vital functions of circulation or respiration, or both.

Depressant Poisons

The depressant poisons usually are medicines or drugs that are given to relieve pain or induce sleep but when taken in excess act as poisons; the more common are opium, morphine, laudanum, and paregoric and sleep-producing preparations, such as sleeping powders.

Symptoms

The most common symptoms of depressant poisons are weariness, drowsiness, sleepiness, and progressive loss of sensibility, ranging to a deep coma. The face is pale or cyanosed, and the skin is cold. The eyes are clear, but the pupils are contracted to a pinpoint and do not react to light. The pulse is at first strong and slow but later becomes rapid and feeble. Respiration at first is slow but later becomes shallow and irregular. Whenever the pupils of both eyes are unusually small and do not react to light, always suspect that opium or an opium derivative has been taken.

Treatment for Opium or Opium Derivative Poisoning

Procure medical aid immediately.

Arouse the patient by dashing cold water on his face and slapping the soles of his feet. Walk him back and forth to keep him aroused.

Promote vomiting by drinks of salt water or mustard water if the patient can be aroused enough to swallow.

If possible, have the patient take repeated drinks of strong black coffee or tea.

Stimulate with aromatic spirits of ammonia by mouth or inhalation at frequent intervals.

Keep the patient warm.

If respiration becomes very feeble, employ artificial respiration and oxygen inhalation.

Alcoholic Poisoning

Symptoms

Alcoholic beverages taken in excess also act as depressant poisons. The patient has the odor of alcohol on his breath. He is partly or completely unconscious, although usually he can be aroused temporarily but soon relapses into a stupor. He often mutters in delirium. In the early stages his face is moist and flushed, his pulse strong, and his breathing deep. Later his face becomes dry and bloated, with a bluish cast, his pulse becomes weak and rapid, and his breathing is shallow. His eyes are bloodshot and his pupils natural or large but of equal size.

Never accept the odor of alcohol on the breath as a positive sign of alcoholic poisoning. Always examine for other

conditions to account for the patient's disability. A person who is not feeling well often takes a drink of alcoholic liquor to brace him up or he may have been taking medicine containing alcohol, and the real condition causing his illness may be overlooked. Frequently a person who has been drinking alcoholic liquors suffers an accident and needs care for an injury. The conditions most likely to be confused with alcoholic poisoning are a fractured skull and apoplexy. A fractured skull may give no external evidence of a head injury. Always carefully examine the eyes of a person believed to be suffering from alcoholic poisoning. If the pupils of the eyes are of unequal size when compared with each other, there is some injury to the brain—a fractured skull, hemorrhage of the brain (apoplexy), or some pressure exerted on it.

Treatment

Procure medical aid promptly.

Arouse the patient, if possible, and give him salt water, mustard water, or soapy water to promote vomiting.

Follow by warm, black coffee, a cup every 15 minutes.

Give aromatic spirits of ammonia by mouth, if possible; if not, by inhalations at frequent intervals.

Keep the patient warm, and combat physical shock.

If respiration becomes very shallow, employ artificial respiration and oxygen inhalation.

Convulsant Poisons

The more common convulsant poisons are:

Nitroglycerin.

Hydrocyanic acid and the cyanides.

Strychnine; belladonna.

Nitroglycerin Poisoning

Symptoms

Mild nitroglycerin poisoning frequently occurs among men who handle explosives high in nitroglycerin. Some persons are highly susceptible to nitroglycerin and should never handle or be around explosives containing it.

The symptoms of nitroglycerin poisoning are a queer, full sensation of the head, giddiness, headache in the frontal region and extending to the back of the head and neck with increasing severity, irregular pulse, dilation of pupils of the eyes, pain in the front of the chest, muscular weakness, nausea and vomiting, loss of consciousness, and convulsions in extreme cases.

Treatment

In mild cases get the patient into fresh air as soon as possible, and stimulate with aromatic spirits of ammonia

and black coffee. Very little can be done to relieve the headache. It will gradually decrease with time, ranging from several hours to a day or more. Keep the patient warm.

Severe cases should have medical attention immediately.

Keep the patient lying down and warm.

Promote vomiting by drinks of salt water or mustard water.

Stimulate the patient with aromatic spirits of ammonia, black coffee, or strong tea.

If respiration fails, employ artificial respiration and oxygen inhalation.

Hydrocyanic-Acid or Cyanide Poisoning

Symptoms

The symptoms of poisoning by hydrocyanic acid or the cyanides are rapid and progressive. The breath may have the odor of bitter almonds; other symptoms are giddiness, nausea and vomiting, decreased sensibility, panting respiration, cyanosis, profound collapse, convulsions with prolonged expiration, and respiratory failure.

Treatment

Procure medical aid immediately, as in most cases life depends on prompt and proper medical care.

Keep the patient lying down and warm.

If the patient can swallow, promote vomiting by drinks of salt water or mustard water.

If the patient can swallow, next give aromatic spirits of ammonia, black coffee, or strong tea. If he cannot swallow, give aromatic spirits of ammonia by inhalation, repeated frequently.

If respiration fails, resort to artificial respiration and oxygen inhalation. However, neither artificial respiration nor oxygen inhalation is of much benefit, because in such poisonings the body tissues are so affected that they cannot utilize the oxygen carried by the blood.

Strychnine Poisoning

Symptoms

The symptoms of strychnine poisoning progress very rapidly, as follows: There is a feeling of suffocation, the face becomes blue, the muscles of the neck become rigid, the neck becomes stiff, and convulsions occur in which the body of the patient arches upward so that he rests on the back of the head and on his heels; he usually remains conscious, and respiration ceases.

Treatment

Procure medical aid immediately, as the life of the patient usually depends on prompt and proper medical treatment.

Give several cups of strong tea.

Promote vomiting by drinks of salt water or mustard water.

Keep the patient absolutely quiet in a dark room.
Give no stimulant.
Do not try to restrain the patient while in convulsions.
If respiration fails, resort to artificial respiration and oxygen inhalation.

POISONS INJECTED WITHIN SKIN

Many poisons may enter the body through breaks in the skin, such as infected wounds, drugs injected hypodermically, or bites of rabid animals, poisonous snakes, and poisonous insects. The last three are the only ones discussed.

BITES OF RABID ANIMALS

Any animal may suffer from hydrophobia (rabies or madness). If a person is bitten by an animal, always suspect the animal to be rabid until it is proved otherwise. The saliva from a rabid animal enters the wound caused by the bite, and the disease is transmitted to the person bitten. A person bitten by an animal always should receive medical attention.

Treatment

Wash the wound with grain alcohol or a thick solution of soap and water; rinse to remove saliva.

Dress with a sterile compress.

Take the patient to a physician at once.

BITES OF POISONOUS SNAKES

Coral snakes, copperheads, rattlesnakes, and water moccasins are poisonous, and their bites are dangerous.

Symptoms

The first symptoms of bites by poisonous snakes are a feeling of stinging pain and one or two small punctured wounds in the part struck, and swelling and discoloration, which are evident in a very short time. The part becomes painful, and as the poison enters the system through the venous circulation general symptoms develop, such as great weakness, nausea, rapid, weak pulse, and a profuse flow of saliva. After a few hours muscular paralysis develops, and the patient passes into a stupor.

Treatment

Treatment should be started at once.

Keep the patient lying down and quiet to slow circulation and retard absorption of the poison.

Immediately apply a constricting bandage, several inches above the wounds, between the wounds and the heart. This retards the flow of blood into the superficial veins and prevents absorption of the poison.

An area several inches square around the wounds should be sterilized with a suitable antiseptic and then incised through

each of the wounds by cuts about $\frac{1}{8}$ inch deep and $\frac{1}{2}$ inch long in the form of an X. A sharp knife, the tip of which has been held in the flame of a burning match, is satisfactory for making the incisions.

Press the outside of the wounds to make them bleed freely. To promote bleeding suck the wounds, and spit out the blood. No harm can come from sucking the wound if there are no sores in the mouth or on the tongue. Continue the bleeding 20 minutes, then loosen the constricting bandage 1 minute. Retighten the constricting bandage, and continue drawing blood from the wounds. Additional incisions may be made around the bites if much swelling takes place. Repeat this procedure until medical aid can be procured.

Treat the patient for physical shock.

Do not give any stimulants.

Several pocket-size snakebite outfits are available. They consist of a web band similar to an army tourniquet with a device to hold it tight, a small lancet in a vial or case, iodine ampoules or swabs, a suction syringe, usually of glass with a rubber extension to fit tightly around the wounds, ampoules of aromatic spirits of ammonia, folded paper cups, and adhesive compresses.

The advantage of these outfits is that there is readily at hand in a small pocket case everything needed for first-aid care of a poisonous snakebite. For persons who frequent regions infested with poisonous snakes these pocket snakebite kits are a great first-aid convenience.

BITES AND STINGS OF INSECTS

Many insects bite or sting, but few are poisonous in the sense that their bite or sting can cause serious symptoms of itself. However, there are insects that do transmit diseases where the insects act as hosts to an organism or virus of those diseases. As examples, certain types of mosquitoes transmit malaria, yellow fever, and other diseases; certain types of ticks transmit spotted or Rocky Mountain fever; and certain types of biting flies transmit tularemia or rabbit fever.

Symptoms

The stings of bees, wasps, yellow jackets, and hornets and the bites of mosquitoes, ticks, fleas, and bedbugs usually cause only local irritation and pain in the region stung or bitten. Moderate swelling and redness may occur, and some itching, burning, and pain may be present.

Treatment

If a sting is left in the wound withdraw it.

Apply a weak ammonia solution—aromatic spirits of ammonia answers the purpose—or a paste made of baking soda and water. Apply these with a compress.

If swelling and pain persist and constitutional symptoms develop, obtain medical care.

Occasionally stinging or biting insects have been feeding on or in contact with poisonous substances, and at the time of the sting or bite such substances may be injected into or come in contact with the wound so made, causing a poisoned or infected wound.

BITES AND STINGS OF SPIDERS, CENTIPEDES, TARANTULAS, AND SCORPIONS

The effects of stings and bites of spiders, centipedes, tarantulas, and scorpions in some instances are much more severe than those of the insects previously mentioned. They may cause alarming symptoms but, except for bites of tarantulas and black-widow spiders, seldom prove fatal.

The black widow is a moderately large, glossy, black spider with very fine hairs over the body, giving it a silky appearance. On the underside of the abdomen is a characteristic red or crimson marking in the form of an hourglass. The female only is poisonous; the male, which is much smaller, is harmless.

Symptoms

The symptoms of the more poisonous insects' stings or bites are 1 or 2 small pinpoint punctures of the skin, local swelling, and redness with a smarting, burning pain. The swelling, redness, and pain increase rapidly; prostration, sweating, nausea, and pain in the back, shoulders, chest, and limbs develop within a few hours. In most instances the constitutional symptoms are mild and subside within 6 to 12 hours but occasionally are severe and end in collapse.

Treatment

Treat as for the less poisonous bites or stings of insects.

Where the swelling and pain are rapid and severe, treat as for poisonous snakebite. Procure medical care as early as possible.

Keep the patient lying down and quiet to retard absorption of poison into the circulation.

Combat physical shock by administering aromatic spirits of ammonia, black coffee, or strong tea.

POISONING BY CONTACT WITH SKIN

Many inorganic and organic substances, in the form of gases, fumes, mists, liquids, and dusts, cause poisoning or dermatoses when they come in contact with the skin. Dermatoses are diseases of the skin and its appendages (hair follicles, sebaceous glands, and sweat glands) and are characterized by alterations in the normal structure, irritation, and inflammation.

Except in few instances, dermatoses do not progress rapidly but manifest themselves gradually after continued exposure to the agents causing them. Persons who note

changes in the normal texture of their skin or continued irritation or inflammation of the skin should seek medical advice before a chronic dermatosis develops. Needless discomfort and loss of time can be prevented by early medical care and application of available preventive measures.

POISON-IVY, POISON-OAK, AND POISON-SUMAC POISONING

These poisonous plants grow as vines or, in locations providing favorable soil and moisture, as shrubs, waist to shoulder high. Socalled poison ivy and poison oak are neither ivy nor oak but species of sumac. The poison emanates principally from their leaves but also may be given off from bruising their roots, stems, and berries. The smoke from burning brush containing the plants has been known to carry the poisonous principle some distance.

Symptoms

The symptoms appear on exposed skin surfaces—usually the hands, wrists, and arms—6 hours to several days after exposure. There is a red rash, with some swelling, itching, and burning, followed by formation of varying-size blisters filled with serum. The blisters may become pustular, and after breaking crusts or scabs are formed or considerable fluid may exude from the broken blisters. If the area affected is considerable and the inflammation severe, as in some cases, there may be fever, headache, and general body weakness. Some persons are much more susceptible than others to the poisonous plants and should avoid contact with them as much as possible.

Treatment

When a person must work in brush where the poisonous plants may occur, the effects of contact may be prevented by previously coating hands and arms with a lather made from strong brown laundry soap and permitting the lather to dry on the parts. Immediately after such work, wash the hands and arms with more brown soap and warm water, and again permit the lather to dry on the parts. A saturated solution of hyposulfite of soda in water may be used instead of the soap lather.

A 5-percent solution of ferric chloride in equal parts of water and alcohol or a solution of hyposulfite of soda (1 tablespoon to a pint of water) applied 4 or 5 times a day, usually dries the eruption. Apply these solutions with cotton sponges, and permit them to dry on the skin. Blisters may be opened with a sterile needle and the serum or pus absorbed on small pads of cotton. Be sure to apply one of the solutions to the part before the blisters are opened and immediately afterward to prevent spread of the disease.

Where the eruption persists, spreads, or is severe, medical attention should be obtained.

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